AQA GCSE Physics | 8463

SPECIFICATION POINT 4.1.3

National and global energy resources

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**106**
Available paper years	**2004–2025**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.1.3 National and global energy resources

Answer 01 · Mark scheme June 2004 | 3451F | Original Q3 | Legacy

The full source mark scheme begins on page 106. Follow original question 3 in that document.

Answer 02 · Mark scheme June 2004 | 3462F3 | Original Q3 | Legacy

The full source mark scheme begins on page 127. Follow original question 3 in that document.

Answer 03 · Mark scheme June 2005 | 3451 | Original Q4 | Legacy

The full source mark scheme begins on page 144. Follow original question 4 in that document.

Answer 04 · Mark scheme June 2005 | 3451 | Original Q5 | Legacy

The full source mark scheme begins on page 144. Follow original question 5 in that document.

Answer 05 · Mark scheme June 2005 | 3462 | Original Q4 | Legacy

The full source mark scheme begins on page 162. Follow original question 4 in that document.

4.1.3 National and global energy resources

Answer 06 · Mark scheme June 2005 | 3462 | Original Q5 | Legacy

The full source mark scheme begins on page 162. Follow original question 5 in that document.

Answer 07 · Mark scheme June 2006 | 3451 | Original Q1 | Legacy

(c)(i)	1	1

Answer 08 · Mark scheme June 2006 | 3462 | Original Q1 | Legacy

The full source mark scheme begins on page 176. Follow original question 1 in that document.

Answer 09 · Mark scheme November 2006 | PHY1A | Original Q2 | Legacy

Two	**A**	falling water	**4**
	B	sunlight	**1**
	C	waves	**2**
	D	wind	**3**

Answer 10 · Mark scheme November 2006 | PHY1A | Original Q3 | Legacy

Three	**A**	**2**
	B	**3**
	C	**4**
	D	**1**

Answer 11 · Mark scheme March 2007 | PHY1A | Original Q2 | Legacy

Two	**A**	coal-fired power stations	**4**
	B	geothermal power stations	**1**
	C	nuclear power stations	**3**
	D	tidal power stations	**2**

4.1.3 National and global energy resources

Answer 12 · Mark scheme March 2007 | PHY1A | Original Q6 | Legacy

Six	**A**	conclusion	**3**
	B	control	**1**
	C	environment	**4**
	D	evidence	**2**

	A	**B**	**C**	**D**

Answer 13 · Mark scheme March 2007 | PHY1A | Original Q9 | Legacy

Nine	**3**	**3**	**3**	**2**

PHY1A (Energy and Electricity) Higher Tier

Question	Key		
One	**A**	conclusion	**3**
	B	control	**1**
	C	environment	**4**
	D	evidence	**2**
Two	**A**	free electrons	**4**
	B	ions	**3**
	C	particles	**1**
	D	waves	**2**

	A	B	C	D
Three	**1**	**1**	**4**	**2**
Four	**3**	**3**	**3**	**2**
Five	**4**	**2**	**4**	**4**
Six	**3**	**1**	**4**	**3**
Seven	**4**	**4**	**4**	**2**
Eight	**1**	**2**	**4**	**2**
Nine	**3**	**1**	**2**	**1**

4.1.3 National and global energy resources

Answer 14 · Mark scheme June 2007 | PHY1A | Original Q3 | Legacy

Three	**A**	hydroelectric	**3**
	B	nuclear	**2**
	C	wind	**1**
	D	tidal	**4**

Answer 15 · Mark scheme June 2007 | PHY1A | Original Q9 | Legacy

Nine	**3**	**3**	**3**	**1**

Answer 16 · Mark scheme June 2007 | PHY1B | Original Q9 | Legacy

Nine	**3**	**1**	**1**	**1**

Answer 17 · Mark scheme June 2007 | PHY1F | Original Q2 | Legacy

The full source mark scheme begins on page 190. Follow original question 2 in that document.

Answer 18 · Mark scheme November 2007 | PHY1A | Original Q1 | Legacy

One	**A**	chemical energy to heat	**3**
	B	electrical energy to heat	**4**
	C	light energy to electrical energy	**1**
	D	kinetic energy to electrical energy	**2**

Answer 19 · Mark scheme November 2007 | PHY1A | Original Q3 | Legacy

Three	**A**	nuclear	**3**
	B	solar	**4**
	C	tides	**2**
	D	wind	**1**

4.1.3 National and global energy resources

Answer 20 · Mark scheme

Question 5

question	answers	extra information	mark
(a)	any **two** from: • *(*burning*)* fossil fuels produces greenhouse gases / pollutant gases / acid rain / leads to global warming • nuclear fuels produce dangerous waste • fossil fuels are non-renewable • renewable energy resources produce no pollutant gases • large amounts of energy are available • <u>running</u> costs are low	accept a named fossil fuel accept a named pollutant gas accept radioactive for dangerous accept reference to dangers of nuclear fuels accept running out of fuels accept renewable won't run out accept any reasonable benefit of renewables accept any reasonable drawback of non-renewables do **not** accept better for the environment on its own	2
(b)	**R U S T**	all in correct order allow **2** marks for 2 correct allow **1** mark for one correct	3
total			5

4.1.3 National and global energy resources

Answer 20 · Mark scheme

January 2008 | PHY1F | Original Q5 | Legacy

PHY1F

4.1.3 National and global energy resources

Answer 21 · Mark scheme

Question 6

question	answers	extra information	mark
(a)(i)	any **one** from: • coal • oil • (natural) gas	do **not** accept fossil fuels accept diesel accept biofuel or a named biofuel eg wood / straw accept household / industrial waste owtte	1
(ii)	0.3	accept 30% if **2** marks not awarded then: allow **1** mark for 30 (without %) allow **1** mark for 0.3 with a unit or % allow **1** mark for identification of energy input and output eg. 20 sq input and 6 sq output **or** 4 sq input and 1.2 sq output **or** 40 sq input and 12 sq output even if subsequent working incorrect allow **1** mark for correct expression of 1.2 over 4 **or** 12 over 40 **or** 6 over 20 (squares)	2
(iii)	(nuclear) fission	accept fision provided it is **not** fusion	1

Question 6 continues on the next page

PHY1F

Question 6 continued

question	answers	extra information	mark
(b)(i)	small proportion of energy / power is wasted **or** transfers most / more / a lot of energy power usefully	accept little / less energy / power / heat is wasted do **not** accept it wastes no energy / power	1
(ii)	it decreases the current / uses low current **or** *it* increases the voltage / potential difference **or** uses high voltage / potential difference smaller the current the smaller the energy loss	 accept pd for potential difference accept power / heat for energy	1 1
(c)(i)	as a control	accept to make a comparison do **not** accept fair test on its own	1
(c)(ii)	so people know how much data the link was based on **or** people can judge the significance / reliability of the link	accept idea that larger numbers are better do **not** accept significance / reliability on its own ignore reference to accuracy	1

Question 6 continues on the next page

PHY1F

Question 6 continued

question	answers	extra information	mark
(iii)	other possible factors may be responsible **or** have not been investigated		1
	named factor eg environment / genetic		1
(iv)	first box ticked plus reason	acceptable reason such as so people know there may be a risk as soon as possible / so that other scientists can use findings	1
	or		
	second box plus reason	acceptable reason such as no point to worry / confuse / panic people *(*until the research has been confirmed*)* accept idea that it may lead to wrong advice do **not** accept in case they are wrong	
total			12

4.1.3 National and global energy resources

Answer 22 · Mark scheme

March 2008 | PHY1AP | Original Q2 | Legacy

Two	**A**	electrical energy	**3**
	B	thermal energy	**4**
	C	light energy	**1**
	D	kinetic energy	**2**

Answer 23 · Mark scheme

March 2008 | PHY1AP | Original Q3 | Legacy

Three	**A**	acid rain	**3**
	B	global warming	**4**
	C	noise pollution	**2**
	D	radioactive waste	**1**

Answer 24 · Mark scheme

March 2008 | PHY1AP | Original Q4 | Legacy

Four	**A**	coal	**2**
	B	natural gas	**4**
	C	oil	**1**
	D	renewable sources	**3**

Answer 25 · Mark scheme

March 2008 | PHY1AP | Original Q9 | Legacy

Nine	**2**	**4**	**3**	**1**

4.1.3 National and global energy resources

Answer 25 · Mark scheme

March 2008 | PHY1AP | Original Q9 | Legacy

SCIENCE A (4461)/PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

March 2008

Higher Tier

Question	Key		
One	**A**	house	**4**
	B	power station	**1**
	C	step-down transformer	**3**
	D	step-up transformer	**2**
Two	**A**	cold water is pumped into the rocks	**1**
	B	steam drives turbines	**3**
	C	turbines drive generators	**4**
	D	water is heated by radioactive decay	**2**

	A	B	C	D
Three	**2**	**4**	**4**	**1**
Four	**2**	**4**	**3**	**1**
Five	**4**	**3**	**3**	**2**
Six	**3**	**2**	**4**	**4**
Seven	**4**	**3**	**2**	**4**
Eight	**4**	**2**	**2**	**2**
Nine	**2**	**3**	**2**	**1**

4.1.3 National and global energy resources

Answer 26 · Mark scheme

June 2008 | PHY1AP | Original Q4 | Legacy

No matching mark scheme was available in the supplied archive for this question.

Answer 27 · Mark scheme

June 2008 | PHY1AP | Original Q5 | Legacy

No matching mark scheme was available in the supplied archive for this question.

Answer 28 · Mark scheme

June 2008 | PHY1AP | Original Q9 | Legacy

No matching mark scheme was available in the supplied archive for this question.

4.1.3 National and global energy resources

Answer 29 · Mark scheme June 2008 | PHY1F | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
(a)	gas oil		1 1
(b)	(both) use steam to drive a turbine	accept (both) use turbines to drive generators do **not** accept both have a turbine /generator / use steam must describe a step in the process accept heat / thermal energy transformed to kinetic / electrical energy	1
(c)	140 (^{o}C)	correct answer only allow **1** mark for method clearly shown on graph accept a cross or other indication at correct position on the line accept correct description accept even if numerical answer is incorrect	2

Question 2 continues on the next page

PHY1F

Question 2 continued

question	answers	extra information	mark
(d)	any **one** from: • very large energy source / reserves • no polluting / harmful gases produced • reduces carbon emissions • no fuel needed • energy is free • can generate energy for a long time • renewable (energy source) • fossil fuels are running out	do **not** accept answers purely in terms of disadvantages of other methods except for fossil fuels are running out accept named gas CO_2 SO_2 NO_x accept reduces harmful carbon emissions accept does not contribute to global warming accept energy available for a long time accept it saves fossil fuels / non-renewable accept reduces the amount of fossil fuels being burnt accept a named fossil fuel Better for the environment / environmentally friendly insufficient it is cheaper is insufficient	1
total			6

4.1.3 National and global energy resources

Answer 29 · Mark scheme June 2008 | PHY1F | Original Q2 | Legacy

PHY1F

Answer 30 · Mark scheme November 2008 | PHY1AP | Original Q2 | Legacy

Two	**A**	geothermal	**3**
	B	(falling water) hydroelectric	**1**
	C	tides	**4**
	D	waves	**2**

Answer 31 · Mark scheme November 2008 | PHY1AP | Original Q6 | Legacy

Six	**2**	**1**	**4**	**3**

Answer 32 · Mark scheme November 2008 | PHY1AP | Original Q7 | Legacy

Seven	**1**	**2**	**2**	**2**

4.1.3 National and global energy resources

Answer 33 · Mark scheme January 2009 | PHY1F | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)	light electrical	correct order only	1 1
3(b)(i)	0.2 **or** 1/5	accept 20% for both marks allow **1** mark for correct substitution answer of 0.2% **or** 20 gains **1** mark ignore units	2
3(b)(ii)	wasted	accept transformed to heat / other forms accept transferred to the air / surroundings sound = neutral	1
3(c)(i)	any **one** from: • can fly at night • can stay in the air for longer • can fly in the winter • can fly faster	 accept can fly when it is cloudy accept as a back-up increases power is neutral	1

Question 3 continues on the next page

PHY1F

Question 3 continued

question	answers	extra information	mark
3(c)(ii)	any **one** from: • produces no (pollutant) gases **or** no greenhouse gases • produces no / less noise • less demand for fuels	accept named gas accept no air pollution do **not** accept no pollution accept less global warming accept harmful for pollutant accept produces no carbon do **not** accept environmentally friendly accept any other sensible environmental advantage	1
3(c)(iii)	accept any sensible suggestion eg, map the Earth's surface / weather forecasting / spying / monitoring changes to the Earth's atmosphere, etc	do **not** accept ideas in terms of transporting accept use as a satellite	1
Total			**8**

4.1.3 National and global energy resources

Answer 33 · Mark scheme January 2009 | PHY1F | Original Q3 | Legacy

PHY1F

4.1.3 National and global energy resources

Answer 34 · Mark scheme

Question 5

question	answers	extra information	mark
5(a)(i)	any **one** from: • waves • tides • falling water • biofuel / biomass • solar • geothermal	 do **not** accept water accept hydroelectric accept sun / sunlight do **not** accept light accept solar cells / panels do **not** accept heat	1
5(a)(ii)	decrease		1
5(b)(i)	 increases from 4 am (to 8 am) remains constant from 8 am (to 10 am)	accept increases from 30 000 accept stays constant from 40 000 allow **1** mark for goes up then stays the same for full credit must be some indication of time or power	 1 1
5(b)(ii)	natural gas		1
Total			**5**

4.1.3 National and global energy resources

Answer 34 · Mark scheme January 2009 | PHY1F | Original Q5 | Legacy

PHY1F

Answer 35 · Mark scheme March 2009 | PHY1AP | Original Q2 | Legacy

Two	**A**	falling water (hydroelectric)	**2**
	B	fossil fuel	**1**
	C	tides	**4**
	D	wind	**3**

Answer 36 · Mark scheme March 2009 | PHY1AP | Original Q3 | Legacy

Three	**A**	fossil fuels	**4**
	B	nuclear	**2**
	C	tides	**3**
	D	wind	**1**

Answer 37 · Mark scheme March 2009 | PHY1AP | Original Q4 | Legacy

Four	**A**	coal	**3**
	B	biofuel	**4**
	C	geothermal	**2**
	D	uranium	**1**

Answer 38 · Mark scheme March 2009 | PHY1AP | Original Q8 | Legacy

Eight	**4**	**3**	**1**	**3**

Answer 39 · Mark scheme June 2009 | PHY1AP | Original Q2 | Legacy

Two	**A**	falling water (hydroelectric)	**3**
	B	geothermal	**2**
	C	solar	**4**
	D	wave	**1**

Answer 40 · Mark scheme June 2009 | PHY1AP | Original Q4 | Legacy

Four	**A**	electrical	**3**
	B	gravitational potential	**1**
	C	heat (thermal energy)	**4**
	D	kinetic	**2**

4.1.3 National and global energy resources

Answer 41 · Mark scheme

Question 2

question	answers	extra information	mark
2(a)(i)	an unreliable energy source		1
2(a)(ii)	a predictable energy source		1
2(b)	plant / grow (at least) one new tree		1
2(c)	greater than 4%		1
Total			**4**

4.1.3 National and global energy resources

Answer 41 · Mark scheme

June 2009 | PHY1F | Original Q2 | Legacy

PHY1F

4.1.3 National and global energy resources

Answer 42 · Mark scheme

June 2009 | PHY1F | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)(i)	France		1
5(a)(ii)	any **one** from: • different homes have different appliances • different homes have different numbers of appliances • standby power not the same for all appliances • some people will switch appliances off • homes have different numbers of residents • can't measure every (individual) home	accept all homes are different accept named appliances accept people waste different amounts of energy accept any sensible suggestions do **not** accept answers in terms of accurate / precise etc	1
5(b)(i)	increases amount of energy wasted	accept (encourages) people to leave appliances on (standby) accept increases it	1

Question 5 continues on the next page . . .

PHY1F

Question 5 continued . . .

question	answers	extra information	mark
5(b)(ii)	any **two** from: • less electricity needed / generated • fewer power stations needed • less coal is burned • less pollutant gases produced	do **not** accept coal is non-renewable / running out answers in terms of fuel stocks neutral accept named gases accept harmful for pollutant accept greenhouse gases accept reduce / slow / stop global warming accept reduces acid rain	2
5(c)	joule		1
5(d)(i)	6800	accept £68 for **3** marks an answer of 68 gains **2** marks allow **2** marks for correct substitution ie 400 × 17 allow **1** mark for obtaining 400 answers of 7480, 4760, 12920, 4080 gain **2** marks	3
5(d)(ii)	a small . . . . . electricity		1
Total			**10**

4.1.3 National and global energy resources

Answer 42 · Mark scheme June 2009 | PHY1F | Original Q5 | Legacy

PHY1F

Answer 43 · Mark scheme November 2009 | PHY1AP | Original Q6 | Legacy

Six	**4**	**2**	**4**	**1**

Answer 44 · Mark scheme November 2009 | PHY1AP | Original Q7 | Legacy

Seven	**3**	**2**	**4**	**2**

4.1.3 National and global energy resources

Answer 45 · Mark scheme

Question 2

question	answers	extra information	mark
2(a)(i)	gas		1
2(a)(ii)	one variable is categoric, the other is continuous		1
2(a)(iii)	fuel is **not** burned	accept nothing is burned do **not** accept they don't use fossil fuels	1
2(b)(i)	boiler steam turbine generator		1 1 1 1
2(b)(ii)	any **one** from: • wind • waves • tidal • geothermal • solar • falling water	 accept wind turbines accept tide accept the Sun / sunlight accept solar panels / cells do **not** accept light accept hydroelectric do **not** accept water do **not** accept any named biofuel	1
2(b)(iii)	18 000	allow **1** mark for showing a correct method ie 36 000 000 ÷ 2 000 an answer of 0.018 gains **1** mark	2
Total			**10**

4.1.3 National and global energy resources

Answer 45 · Mark scheme

January 2010 | PHY1F | Original Q2 | Legacy

PHY1F

4.1.3 National and global energy resources

Answer 46 · Mark scheme

Question 7

question	answers	extra information	mark
7(a)(i)	(two) nuclei (of light elements) join forming a larger / heavier nucleus / one	accept hydrogen atoms for nuclei accept comparative term equivalent to larger accept forms a helium (nucleus / atom) this mark only scores if fusion is in terms of hydrogen atoms	1 1
7(a)(ii)	stars	accept a named star e.g. the Sun accept nebula mention of planets negates answer	1
7(b)(i)	any **one** from: • (currently) only experimental • reaction does not last long enough • use more energy than they produce	allow difficult to control do **not** allow inefficient on its own	1
7(b)(ii)	any **one** from: • will give another source of energy • unlimited fuel supplies / energy • would not produce any radioactive waste • want to show that it can be done	do **not** accept answers only in terms of fossil fuels or carbon dioxide accept unlimited hydrogen accept less radioactive waste accept nuclear for radioactive do **not** accept toxic waste accept any sensible suggestion	1

Question 7 continues on the next page . . .

PHY2F

Question 7 continued . . .

question	answers	extra information	mark
7(c)(i)	any **one** from: • repeating did not produce the same results / data • experiments were not / may not be reproducible • data / experiments were not valid	accept could not be repeated accept has not been repeated do **not** accept answers in terms of scientists being biased	1
7(c)(ii)	any **one** from: • cannot trust journalists • newspaper journalist may not have a science background • newspaper may publish what people want to read • newspaper may simplify ideas • people believe / trust the scientists writing the journal • people have heard of the scientists writing in the journal • scientists writing in the journal are famous • journal only publishes the work of respected / famous scientists • data is checked by other scientists before published in the journal	bias is insufficient on its own accept any sensible suggestion, these are examples they do not constitute a full list	1
Total			**7**

4.1.3 National and global energy resources

Answer 47 · Mark scheme March 2010 | PHY1AP | Original Q4 | Legacy

Four	**A**	Electricity is produced.	**4**
	B	Fission of uranium produces heat.	**1**
	C	The heat is used to produce steam.	**2**
	D	The turbine drives a generator.	**3**

Answer 48 · Mark scheme March 2010 | PHY1AP | Original Q6 | Legacy

Six	**3**	**4**	**2**	**1**

Answer 49 · Mark scheme March 2010 | PHY1AP | Original Q7 | Legacy

Seven	**1**	**4**	**2**	**1**

Answer 50 · Mark scheme June 2010 | PHY1AP | Original Q3 | Legacy

Three	**A**	fossil fuels	**1**
	B	hot rocks	**2**
	C	moving air	**4**
	D	sunlight	**3**

Answer 51 · Mark scheme June 2010 | PHY1AP | Original Q4 | Legacy

Four	**A**	gas-fired	**2**
	B	hydroelectric	**1**
	C	nuclear	**3**
	D	wind farm	**4**

Answer 52 · Mark scheme June 2010 | PHY1AP | Original Q5 | Legacy

Five	**A**	Coal	**4**
	B	Gas	**1**
	C	Hydroelectric (falling water)	**2**
	D	Nuclear	**3**

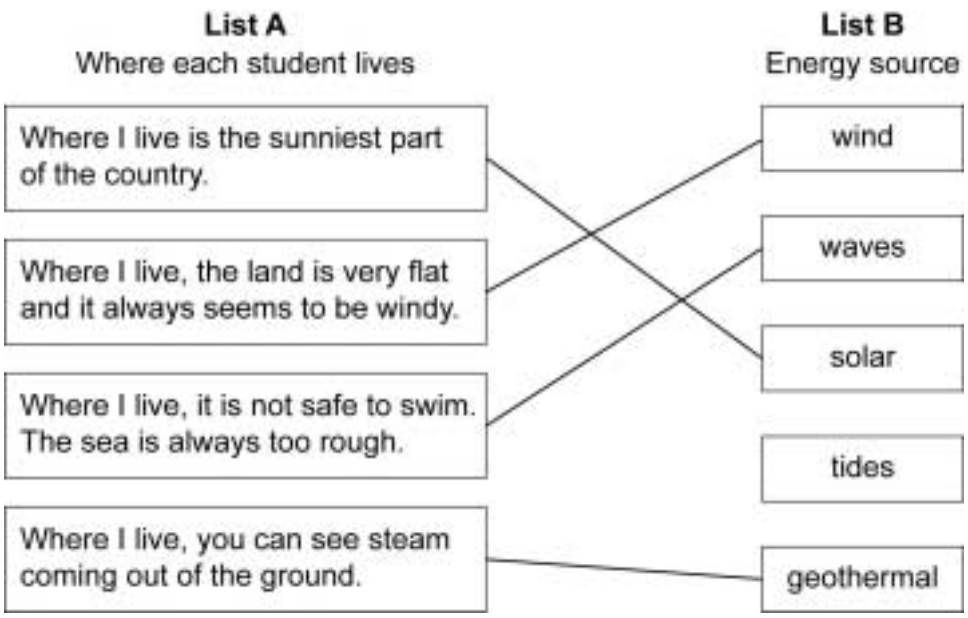
	A	**B**	**C**	**D**

4.1.3 National and global energy resources

Answer 53 · Mark scheme

June 2010 | PHY1F | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a)	all 4 lines correct  	allow **1** mark for each correct line if more than 1 line goes from a box in **List A** then all those lines are incorrec	4
1(b)	all renewable	accept a correct description of renewable eg replaced faster than used **or** never run out do **not** accept can be used again accept any other common feature eg do not produce pollution / polluting (gases) no fuel is burnt (energy input) is free eco-friendly / environmentally friendly / natural resources / sustainable sources are insufficient	1
1(c)	large areas of land are flooded		1
Total			**6**

4.1.3 National and global energy resources

Answer 53 · Mark scheme June 2010 | PHY1F | Original Q1 | Legacy

PHY1F

Answer 54 · Mark scheme November 2010 | PHY1AP | Original Q2 | Legacy

Two	**A**	gas	**4**
	B	geothermal	**3**
	C	moving water	**2**
	D	uranium	**1**

Answer 55 · Mark scheme November 2010 | PHY1AP | Original Q4 | Legacy

Four	**A**	coal-fired	**4**
	B	hydroelectric	**3**
	C	nuclear	**2**
	D	tidal barrage	**1**

Answer 56 · Mark scheme November 2010 | PHY1AP | Original Q9 | Legacy

Nine	**2**	**3**	**3**	**4**

4.1.3 National and global energy resources

Answer 57 · Mark scheme

Question 1

question	answers	extra information	mark
1(a)(i)	solar and wind	both required for mark either order	1
1(a)(ii)	37(%)	accept their **two** sources in a(i) correctly added as an error carried forward (ecf)	1
1(b)	**A**		1
1(c)	gas is non-renewable	do **not** accept they are not all renewable statements such as gas produces CO_2 is neutral	1
Total			**4**

4.1.3 National and global energy resources

Answer 57 · Mark scheme January 2011 | PHY1F | Original Q1 | Legacy

PHY1F

4.1.3 National and global energy resources

Answer 58 · Mark scheme

Question 5

question	answers	extra information	mark
5(a)	kinetic		1
5(b)	**Z**		1
5(c)(i)	generates a lot more energy / electricity / power **or** can supply (energy / electricity / power) to more homes	need fewer conventional large-scale hydroelectric power stations is neutral	1
5(c)(ii)	Large areas of land are flooded.		1
5(d)(i)	National Grid	this answer only	1
5(d)(ii)	less energy / heat loss (from the cables)	accept wasted for loss accept answers in terms of fewer transformers needed do **not** accept less electricity lost / wasted do **not** accept no energy lost	1

Question 5 continues on the next page . . .

PHY1F

Question 5 continued . . .

question	answers	extra information	mark
5(e)	any **one** from: • fewer rivers (suitable for generators) • less mountainous (so rivers fall smaller distances)	accept answers in terms of difficulty linking villages and towns to grid (in Nepal) accept answers in terms of more isolated communities accept answers in terms of UK having more resources for large-scale power stations	1
Total			**7**

4.1.3 National and global energy resources

Answer 58 · Mark scheme January 2011 | PHY1F | Original Q5 | Legacy

PHY1F

Answer 59 · Mark scheme March 2011 | PHY1AP | Original Q1 | Legacy

Question			Key
One	**A**	falling water	**4**
	B	sunlight	**1**
	C	waves	**2**
	D	wind	**3**

Answer 60 · Mark scheme March 2011 | PHY1AP | Original Q4 | Legacy

Four	**A**	coal-fired	**1**
	B	geothermal	**3**
	C	nuclear	**2**
	D	wind farm	**4**

Answer 61 · Mark scheme March 2011 | PHY1AP | Original Q7 | Legacy

Seven	**1**	**3**	**2**	**1**

Answer 62 · Mark scheme March 2011 | PHY1AP | Original Q8 | Legacy

Eight	**2**	**4**	**2**	**4**

Answer 63 · Mark scheme June 2011 | PHY1AP | Original Q5 | Legacy

Five	**A**	10%	**2**
	B	20%	**3**
	C	40%	**4**
	D	50%	**1**

	A	**B**	**C**	**D**

Answer 64 · Mark scheme June 2011 | PHY1AP | Original Q6 | Legacy

Six	**4**	**2**	**1**	**1**

Answer 65 · Mark scheme June 2011 | PHY1AP | Original Q8 | Legacy

Eight	**2**	**1**	**1**	**3**

4.1.3 National and global energy resources

Answer 66 · Mark scheme

June 2011 | PHY1F | Original Q8 | Legacy

Question 8

question	answers	extra information	mark
8(a)(i)	decommissioning		1
8(a)(ii)	level of radiation **or** radiation dose (to workers) decreased	accept the isotope / cobalt(-60) has decayed (a lot) accept the isotope / cobalt(-60) has decayed in 2 half lives accept exposed to less radiation do **not** accept no radiation left	1
	less hazardous / dangerous (to workers health)	accept safer do **not** accept there is no hazard accept allows reactor to cool (down) an answer of radiation levels decrease by 75 % or drops to 25 % gains **2** marks	1
8(b)(i)	more in favour **or** fewer against	quoting figures alone is insufficient do **not** accept it increases ignore any reasons given	1

Question 8 continues on the next page

PHY1F

Question 8 continued

question	answers	extra information	mark
8(b)(ii)	any **one** from: • sample too small • do not know how many (people) were asked • different people asked (in different years) • sample not representative (of population) • people did not understand the questions • do not know who carried out the surveys • do not know if surveys asked same questions	do **not** accept they are biased unless acceptable reason for bias given	1

Question 8 continues on the next page

PHY1F

Question 8 continued

question	answers	extra information	mark
8(b)(iii)	any **one** from: • no / less pollutant gases produced • reliable source (of energy / electricity) • running out of fossil fuels • conserve fossil fuels • meet increasing demand • less reliance on imported fossil fuels / electricity • concentrated energy source(s) • lower transportation costs for fuel • to replace old <u>nuclear</u> power stations	accept a named gas accept does not contribute to global warming accept a named fossil fuel accept fossil fuels won't have to be used accept named fossil fuel ignore references to efficiency / job creation / local economy / selling electricity	1
8(c)	economic issues		1
Total			**7**

4.1.3 National and global energy resources

Answer 67 · Mark scheme November 2011 | PHY1AP | Original Q1 | Legacy

Question	Key		
One	**A**	geothermal	**3**
	B	hydroelectric	**1**
	C	nuclear fuel	**4**
	D	wind	**2**

Answer 68 · Mark scheme November 2011 | PHY1AP | Original Q4 | Legacy

Four	**A**	coal-fired	**2**
	B	geothermal	**3**
	C	nuclear	**4**
	D	tidal	**1**

Answer 69 · Mark scheme November 2011 | PHY1AP | Original Q5 | Legacy

Five	**A**	coal	**1**
	B	natural gas	**3**
	C	nuclear fuel	**2**
	D	wind	**4**

	A	**B**	**C**	**D**

Answer 70 · Mark scheme November 2011 | PHY1AP | Original Q6 | Legacy

Six	**4**	**3**	**3**	**1**

Answer 71 · Mark scheme November 2011 | PHY1AP | Original Q7 | Legacy

Seven	**4**	**3**	**3**	**3**

Answer 72 · Mark scheme November 2011 | PHY1BP | Original Q9 | Legacy

Nine	**3**	**4**	**4**	**3**

4.1.3 National and global energy resources

Answer 73 · Mark scheme

June 2012 | PH1FP | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)	gas (burning)		1
5(b)(i)	(transmission) cables and (step-up and step-down) transformers	if transformers are named ie step-up transformer then both step-up and step-down must be given mention of power station or consumer negates mark	1
5(b)(ii)	voltage more efficient		1 1
5(c)	increase		1
Total			**5**

4.1.3 National and global energy resources

Answer 73 · Mark scheme

June 2012 | PH1FP | Original Q5 | Legacy

PH1FP

4.1.3 National and global energy resources

Answer 74 · Mark scheme

June 2012 | PH1FP | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)	any **two** from: • black is a good emitter of (infrared radiation) • large surface (area) • matt surfaces are better emitters (than shiny surfaces)	accept heat for radiation ignore reference to absorbing radiation accept matt surfaces are good emitters ignore reference to good conductor	2
7(b)	90 % or 0.9(0)	efficiency = useful energy out / total energy in (×100%) allow **1** mark for correct substitution ie 13.5 / 15 provided no subsequent step shown an answer of 90 scores **1** mark an answer of 90 / 0.90 with a unit scores **1** mark	2
7(c)	(producing) light	allow (producing) sound	1

Question 7 continues on the next page

PH1FP

Question 7 continued

question	answers	extra information	mark
7(d)	any **two** from: • wood is renewable • (using wood) conserves fossil fuels • wood is carbon neutral	 accept wood grows again / quickly accept wood can be replanted accept doesn't use fossil fuels accept a description cheaper / saves money is insufficient	2
7(e)	 2 550 000 joules /J	$E = m \times c \times \theta$ allow **1** mark for correct substitution ie $100 \times 510 \times 50$ provided no subsequent step shown answers of 1 020 000, 3 570 000 gain **1** mark accept kJ / MJ do **not** accept j for full credit the unit and numerical answer must be consistent	 2 1
Total			**10**

4.1.3 National and global energy resources

Answer 74 · Mark scheme

June 2012 | PH1FP | Original Q7 | Legacy

PH1FP

4.1.3 National and global energy resources

Answer 75 · Mark scheme

June 2012 | PH1FP | Original Q8 | Legacy

Question 8

question	answers	extra information	mark
8(a)(i)	energy from hot rocks in the Earth	accept heat that occurs naturally in the Earth accept steam / hot water rising to the Earth's surface accept an answer in terms of the energy released by radioactive decay in the Earth heat energy is insufficient	1
8(a)(ii)	water is pumped / moved up (to a higher reservoir)	 this mark point only scores if first mark point is awarded	1 1
8(b)			6

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 4 and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content	There is a brief description of at least one advantage or disadvantage for either the planned wind turbines or the suggested electricity power link.	There is a description of advantages and disadvantages for either the planned wind turbines or the suggested electricity power link. **or** A description of the advantages or disadvantages for both the planned wind turbines and the suggested electricity power link.	There is a clear and detailed description of at least one advantage and one disadvantage for both the planned wind turbines and suggested electricity power link.

Question 8 continues on the next page

PH1FP

Question 8 continued

examples of the points made in the response	extra information
Offshore wind turbines	
advantages	
• renewable (energy resource)	
• low running costs	
• energy is free	
• no gas emissions (when in use)	accept a named gas eg CO_2 accept no fuel is burned accept less dependent on fossil fuels
• land is not used (up)	
disadvantages	
• unreliable – accept wind does not always blow	ignore references to destroying or harming habitats
• hazard to birds / bats	
• visual pollution – do not accept noise pollution	do **not** allow if clearly referring to onshore wind turbines
• difficulty of linking turbines to the National Grid	do **not** accept spoils landscape
• large initial cost	
• difficult to erect / maintain	accept a lot of maintenance needed
• CO_2 emissions in manufacture (of large number of turbines)	

Question 8 continues on the next page

PH1FP

Question 8 continued

examples of the points made in the response	extra information
Suggested Link	
advantages	
• income for Iceland	
• using Iceland's (available) energy (resources)	accept using (Iceland's) renewable energy (resources) do **not** accept reduce the amount of Iceland's wasted energy
• provide electricity when wind does not blow / reliable	
• provide electricity at times of peak demand	
• even out fluctuations in supply	
• excess electricity from Britain (windy days) to Iceland and used to pump water up to store energy	
• Britain less dependent on fossil fuels	accept Britain needs fewer (new) power stations accept conserves fossil fuels
disadvantages	
• large initial cost	accept expensive (to lay cables)
• power loss along a long cable	
• (engineering) difficulties in laying / maintaining the cable	accept difficult to repair (if damaged)

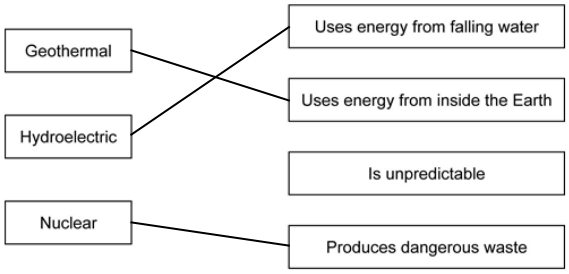
Total			**9**

UMS Conversion Calculator www.aqa.org.uk/umsconversion

4.1.3 National and global energy resources

Answer 76 · Mark scheme

Question 1

question	answers	extra information	mark
1		allow **1** mark for each correct line if more than one line goes from an energy source then all lines from that energy source are wrong	3
Total			**3**

4.1.3 National and global energy resources

Answer 76 · Mark scheme

January 2013 | PH1FP | Original Q1 | Legacy

PH1FP

4.1.3 National and global energy resources

Answer 77 · Mark scheme

January 2013 | PH1FP | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)	electrical chemical light		1 1 1
2(b)	25 % **or** 0.25	allow **1** mark for correct substitution, ie 50 ÷ 200 provided no subsequent step shown **or** answers of 25 with a unit **or** 0.25 with a unit gain **1** mark answers of 25 without a unit **or** 0.25% gain **1** mark	2
2(c)	the information board can be used anywhere it is needed		1
Total			**6**

4.1.3 National and global energy resources

Answer 77 · Mark scheme

January 2013 | PH1FP | Original Q2 | Legacy

PH1FP

4.1.3 National and global energy resources

Answer 78 · Mark scheme

Question 8

question	answers	extra information	mark
8(a)	any **three** from: • gas can be switched on (and off) quickly but nuclear cannot • gas can be used to meet surges in demand • gas can contribute to / meet the base load • nuclear provides base load **or** nuclear is used to generate all of the time	gas has a short start-up time alone is insufficient accept specific times from graph, anything from 1700 to 2200	3

8(b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.		6

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	There is a brief description of one advantage **or** disadvantage of using either biogas or wind **or** makes a conclusion with a reason.	There is a description of some advantages **and / or** disadvantages for biogas **and / or** wind **or** there is a direct comparison between the two systems **and** at least one advantage / disadvantage **or** a detailed evaluation of one system only with a conclusion.	There is a clear and detailed comparison of the two systems. There must be a clear conclusion of which system would be best with at least one comparative reason given for the choice made.

Question 8 continues on the next page . . .

PH1FP

Question 8 continued . . .

examples of the points made in the response	extra information
Biogas	
• renewable	
• energy resource is free	
• reliable energy source	accept works all of the time
• does not depend on the weather	
• uses up (animal) waste products	
• concentrated energy source	
• cheaper (to buy and install)	accept once only
• shorter payback-time (than wind)	
• adds carbon dioxide to the atmosphere	when waste burns it produces carbon dioxide is insufficient
• contributes to the greenhouse effect **or** contributes to global warming	
• no transport cost for fuels	
Wind turbine	
• renewable	
• energy resource is free	
• not reliable	
• depends on the weather / wind	
• will be times when not enough electricity generated for the farm's needs	
• dilute energy source	
• longer payback-time (than biogas)	
• more expensive (to buy and install)	accept once only
• does not produce any carbon dioxide	accept pollutant gases for carbon dioxide accept does not pollute air
	produces visual or noise pollution is insufficient harmful gases is insufficient

Total			**9**

4.1.3 National and global energy resources

Answer 78 · Mark scheme

January 2013 | PH1FP | Original Q8 | Legacy

PH1FP

4.1.3 National and global energy resources

Answer 79 · Mark scheme

June 2013 | PH1FP | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a)(i)	77		1
1(a)(ii)	Oil		1
1(b)	water	accept H_2O	1
1(c)	Carbon dioxide causes global warming		1
Total			**4**

4.1.3 National and global energy resources

Answer 79 · Mark scheme

June 2013 | PH1FP | Original Q1 | Legacy

PH1FP

4.1.3 National and global energy resources

Answer 80 · Mark scheme

June 2013 | PH1FP | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)(i)	changing the distance may / will affect / change the voltmeter reading	accept so only one independent variable accept distance affects speed of wind (turbine) accept it is a control variable accept to give valid results fair test is insufficient to make the results accurate is insufficient	1
4(a)(ii)	any sensible practical suggestions, eg • so fan reaches a steady / full speed • so wind (turbine) reaches a steady / full speed • so voltmeter reaches / gives a steady reading	accept power for speed accept accurate or valid reading a correct reading is insufficient do **not** accept precise reading	1
4(a)(iii)	as the number of blades increases so does the (voltmeter) reading / output / voltage further relevant detail, eg • voltmeter increase is greatest up to 3 blades • voltmeter reading hardly changes with 4, 5 or 6 blades • increase is directly proportional up to 3 blades • it reaches a limit • a numerical example giving two pairs of numbers, eg 2 blades = 0.6V, 4 blades = 1V	number of blades affects the reading / output is insufficient accept does not change between 4 and 6 blades accept does not change after 4 / 5 blades	1 1
4(b)	C wind speed / strength varies	reason scores only if C is chosen accept wind is **not** constant / reliable	1 1
Total			**6**

4.1.3 National and global energy resources

Answer 80 · Mark scheme

June 2013 | PH1FP | Original Q4 | Legacy

PH1FP

4.1.3 National and global energy resources

Answer 81 · Mark scheme

June 2013 | PH2FP | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)	uranium-235	accept any correct indication	1
5(b)	splits / breaks (into two smaller parts)	nucleus is separated is insufficient do **not** accept atom splits – on its own	1
	and (two / three) neutrons		1
5(c)	steam	correct order only	1
	turbine		1
	generator		1
Total			**6**

4.1.3 National and global energy resources

Answer 81 · Mark scheme

June 2013 | PH2FP | Original Q5 | Legacy

PH2FP

4.1.3 National and global energy resources

Answer 82 · Mark scheme

June 2013 | PH3FP | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)	iron primary secondary	correct positions only	1 1 1
2(b)	(it) decreases the p.d.	accept it would increase current accept voltage for p.d. the voltage goes from 230(V) to 20(V) is insufficient do **not** accept decreases current / energy / power do **not** accept decreases p.d. / voltage and current	1
2(c)	any **one** from: • lighter • smaller • use (very) little power / current / energy when switched on and no load / phone not connected • more efficient	accept it is easier to carry around accept no power / current / energy is drawn do **not** accept electricity for power / current / energy accept does not get as hot **or** less heat produced	1
2(d)	an environmental		1
Total			**6**

4.1.3 National and global energy resources

Answer 82 · Mark scheme

June 2013 | PH3FP | Original Q2 | Legacy

PH3FP

4.1.3 National and global energy resources

Answer 83 · Mark scheme June 2014 | PH1FP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO spec ref
4(a)(i)	water		1	AO1 1.4.1d
	heated	accept boiled or turned to steam do **not** accept evaporated	1	
	generator		1	
4(a)(ii)	geothermal power stations provide a reliable source of electricity		1	AO1 1.4.1d
4(b)	falling water		1	AO1 1.4.1b
Total			**5**	

4.1.3 National and global energy resources

Answer 84 · Mark scheme June 2014 | PH1FP | Original Q7 | Legacy

Question	Answers	Extra information	Mark	AO spec ref
7(a)	advantage any **one** from: • produce no / little greenhouse gases / carbon dioxide	allow produces no / little polluting gases allow doesn't contribute to global warming / climate change allow produce no acid rain / sulphur dioxide reference to atmospheric pollution is insufficient produce no harmful gases is insufficient	1	AO1 1.4.1a
	• high(er) energy density in fuel	accept one nuclear power station produces as much power as several gas power stations nuclear power stations can supply a lot of or more energy is insufficient		
	• long(er) operating life	allow saves using reserves of fossil fuels or gas		
	disadvantage any **one** from: • produce (long term) radioactive waste • accidents at nuclear power stations may have far reaching or long term consequences • high(er) decommissioning costs • long(er) start up time	accept waste is toxic accept nuclear for radioactive accept high(er) building costs	1	

Question 7 continues on the next page . . .

Question 7 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
7(b)(i)	12 000 (kWh)	allow **1** mark for correct substitution eg 2000 × 6 **or** 2 000 000 × 6 **or** $\frac{12\,000\,000}{1000}$ an answer of 12 000 000 scores **1** mark	2	AO2 1.3.1c
7(b)(ii)	any idea of unreliability, eg • wind is unreliable • shut down if wind too strong/weak • wind is variable	reference to weather alone is insufficient	1	AO1 1.4
7(c)	any **one** from: • cannot be seen • no hazard to (low flying) aircraft / helicopters • unlikely to be or not damaged / affected by (severe) weather • (normally) no / reduced shock hazard	unlikely to be damaged is insufficient safer is insufficient less maintenance is insufficient installed in urban areas is insufficient	1	AO1 1.4
Total			**6**	

4.1.3 National and global energy resources

Answer 85 · Mark scheme June 2015 | PH1FP | Original Q5 | Legacy

The full source mark scheme begins on page 202. Follow original question 5 in that document.

Answer 86 · Mark scheme June 2016 | PH1FP | Original Q1 | Legacy

The full source mark scheme begins on page 218. Follow original question 1 in that document.

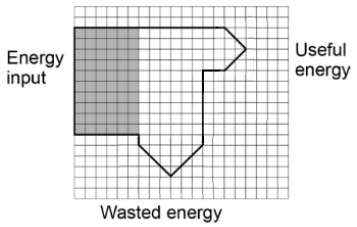
Answer 87 · Mark scheme June 2016 | PH1FP | Original Q7 | Legacy

The full source mark scheme begins on page 218. Follow original question 7 in that document.

4.1.3 National and global energy resources

Answer 88 · Mark scheme

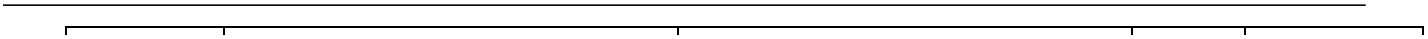
June 2017 | PH1FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	correct arrow widths 4 squares and 6 squares correct labels of useful and wasted energy  		1 1	AO1 1.2HSW
2(b)	a high proportion of the energy output is useful		1	AO1 1.2HSW
2(c)	720 000 (J)	accept 720 kJ for 2 marks allow **1** mark for correct substitution provided no subsequent step ie E = 200 x 3600	2	AO2 1.3.1c
2(d)	any **two** from: • greater input • takes less time to charge • energy sources are renewable • can be used in remote location • no carbon dioxide released or greenhouse gases or doesn't contribute to global warming • no fuel / running cost • wind turbine can recharge the batteries at night • when it isn't windy, solar cells can recharge batteries	more efficient is insufficient	2	AO3 1.3HSW 1.4HSW
Total			**7**	

4.1.3 National and global energy resources

Answer 88 · Mark scheme

June 2017 | PH1FP | Original Q2 | Legacy



4.1.3 National and global energy resources

Answer 89 · Mark scheme

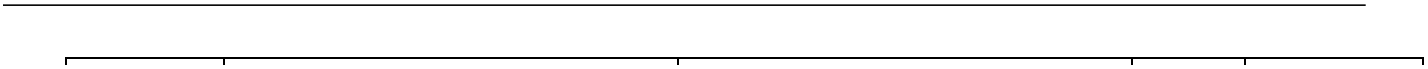
June 2017 | PH1FP | Original Q7 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)	any **two** from: • length / area / size / shape of turbine blades • wind speed • angle of blades / hairdryer	ignore mass / weight / number of turbine blades ignore material of turbine blades accept distance / position of hairdryer allow power setting on hairdryer ignore speed of the turbine spinning	2	AO3 1.4.1b
7(b)(i)	3 points plotted correctly	allow **1** mark for 1 or 2 points plotted correctly ignore any line of best fit drawn	2	AO2 1.4.1b
7(b)(ii)	random (error)	ignore reference to anomaly	1	AO3 1.4.1b
7(b)(iii)	zero output voltage with 1 blade (as number of blades increases) output voltage increases	accept turbine didn't rotate with 1 turbine blade accept (as number of blades increases) speed increases do not accept direct proportion	1 1	AO3 1.4.1b
7(c)	any **two** from: • output voltage / power (required) • mass / weight / material / area / size / shape / length of blades • height / position / location of turbine • cost to construct turbine • environmental impact of wind turbine	ignore reference to efficiency ignore number of blades unqualified allow payback time accept reference to noise / visual pollution	2	AO3 1.4.1b
Total			**9**	

4.1.3 National and global energy resources

Answer 89 · Mark scheme

June 2017 | PH1FP | Original Q7 | Legacy



4.1.3 National and global energy resources

Answer 90 · Mark scheme June 2017 | PH1FP | Original Q9 | Legacy

9	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.	6	AO1 AO2 AO3 1.1.1cde

0 marks	**Level 1 (1-2 marks)**	**Level 2 (3-4 marks)**	**Level 3 (5-6 marks)**
No relevant information	A description of how at least **one** feature makes design A better than design B.	A basic explanation in terms of physical processes of how some features of design A make it better than design B.	A clear and correct explanation in terms of physical processes, including direct comparisons, of how most features of design A make it better than design B.

examples of physics points made in the response

colour of pipe:

- black (pipe) surface is a good absorber of IR radiation / energy

material of pipe:

- metal pipes are good conductors

or

- metal pipes are better conductors than plastic pipes
- higher rate of energy transfer through metal pipe

colour of surface:

- (inside of solar panel is) white / shiny surface which is a good reflector of IR radiation to the pipe
- (inside of solar panel is) white / shiny surface which is a poor absorber of IR radiation

Insulation:

- layer of insulation reduces conduction through base of solar panel

length of pipe / surface area of pipe:

- water is in solar panel for longer time
- water absorbs more energy
- pipe absorbs more IR

design A has a greater water temperature increase (could be linked to any feature)

extra information

accept converse answers in terms of why design B is worse than design A

allow heat / radiation for IR throughout

Total			**6**

4.1.3 National and global energy resources

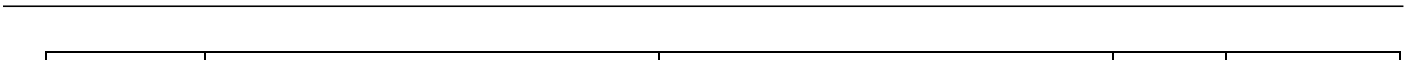
Answer 91 · Mark scheme June 2018 | 8463/1F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	nucleus neutron gamma rays	in this order only	1 1 1	AO1 4.4.4.1
06.2	$\frac{25\,000\,000}{2\,400\,000}$ 11	an answer of 11 scores **2** marks an answer of 10.4 with no working scores **1** mark	1 1	AO2 4.1.3
06.3	any **two** from: • waste is radioactive • waste has a long half-life • waste is toxic • waste needs to be buried • risk of catastrophic accidents • fuel is non-renewable	allow nuclear waste allow waste remains dangerous for a long time allow waste is difficult to dispose of allow named accident eg Fukushima, Chernobyl, Three Mile Island	2	AO1 4.1.3
06.4	**similarity:** (carbon dioxide concentration and global temperature have) both increased **difference:** the carbon dioxide (concentration) continues to increase whereas temperature (increase) levels off	allow they both show a positive correlation allow carbon dioxide (concentration) increases more quickly than temperature (increase)	1 1	AO3 4.1.3
Total			**9**	

4.1.3 National and global energy resources

Answer 91 · Mark scheme

June 2018 | 8463/1F | Original Q6



4.1.3 National and global energy resources

Answer 92 · Mark scheme June 2018 | 8463/1F | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	higher		1	AO2 4.1.2.1
08.2	low(er) hot(ter)	 allow warm(er)	1 1	AO1 4.1.2.1
08.3	advantage: • water heated continuously (by the Sun) **one** disadvantage from: • temperature of water is lower (for most of the time than water heated by immersion heater) • water may not be hot enough • it takes longer to heat the water	 allow less control over water temperature	 1 1	AO3 4.1.3
08.4	$\frac{4\ 030\ 000}{4\ 070\ 000}$ 0.99	an answer of 0.99 scores **2** marks allow an answer that rounds to 0.99 for **2** marks an answer of 99% scores **2** marks an answer of 99 or 0.99% scores **1** mark	 1 1	AO2 4.1.2.2
08.5	power = energy transferred / time	allow P = E / t	1	AO1 4.1.1.4

4.1.3 National and global energy resources

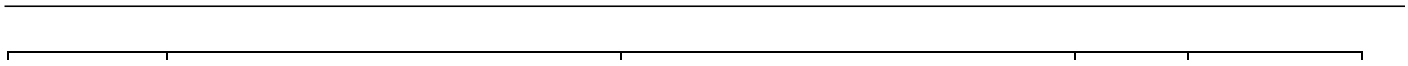
Answer 92 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6		an answer of 814 seconds scores **4** marks an answer of 13.57 minutes scores **4** marks		
	$5000 = \frac{4\ 070\ 000}{t}$		1	AO2 4.1.1.4
	$t = \frac{4\ 070\ 000}{5000}$		1	AO2 4.1.1.4
	$t = 814$		1	AO2 4.1.1.4
	seconds	other units of time must be consistent with numerical value	1	AO1 4.1.1.4
Total			**12**	

4.1.3 National and global energy resources

Answer 92 · Mark scheme

June 2018 | 8463/1F | Original Q8



4.1.3 National and global energy resources

Answer 93 · Mark scheme

June 2019 | 8463/1F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5.1	carbon dioxide released	greenhouse gases is insufficient carbon emissions is insufficient allow CO_2	1	4.1.3 WS1.4 AO1
	causing global warming	allow climate change allow named consequence of global warming allow greenhouse effect air pollution is insufficient	1	
	OR			
	particulates released (1)			
	causing global dimming (1)			
	OR			
	sulfur dioxide released (1)	allow SO_2		
	causing acid rain (1)			
5.2	any **2** from: • wind • tidal • wave • hydroelectric • geothermal • biofuel	do not accept solar allow pumped storage hydro is insufficient allow biomass or named biofuel eg wood	2	4.1.3 AO2
5.3		an answer of 22 (%) scores **2** marks		4.1.3 AO2
	100 – 78	allow **1** mark for calculating percentage of named resources (78%)	1	
	22 (%)		1	

5.4	maximum demand = 37 500 (MW) **and** minimum demand = 25 000 (MW) difference in demand = 12 500 (MW)	an answer of 12 500 (MW) scores **2** marks	1 1	4.1.3 AO2
5.5	solar panels generate electricity from light power output would increase throughout the morning **or** power output would increase (between 06:00 and 09:00) **or** (between 06:00 and 09:00) the Sun is rising / shining	solar panels make energy is insufficient	1 1	4.1.3 1AO1/1 1AO3/2a
Total			**10**	

4.1.3 National and global energy resources

Answer 94 · Mark scheme

November 2020 | 8463/1F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	K = step-up transformer L = transmission cables M = step-down transformer	 allow power cables ignore wires allow 1 mark if K and M are labelled transformer but step-up and step-down labels are incorrect or not present	1 1 1	AO1 4.2.4.3
01.2	8 (%) and 32 (%) Number of times = 4	both required	1 1	AO2 4.1.3
01.3	(burning gas) releases carbon dioxide which causes global warming	 allow greenhouse effect **or** climate change	1 1	AO1 4.1.3
01.4	An energy resource that can be replenished quickly.		1	AO1 4.1.3
01.5	higher power output lower variation in power output	allow more electricity generated	1 1	AO3 4.1.3
Total			**10**	

Answer 95 · Mark scheme

November 2020 | 8463/1F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	radiotherapy		1	AO1 4.4.3.1
05.2	a neutron energy gamma rays	energy and gamma rays can score in reverse order	1 1 1	AO1 4.4.4.1
05.3	An alpha particle is the same as a helium nucleus.		1	AO1 4.4.2.2
05.4	24 000 (years)	allow an answer between 24 000 and 24 500 (years) inclusive	1	AO2 4.4.2.3
05.5	24 000 (years) **or** their **05.4**		1	AO1 4.4.2.3
05.6	Any **one** from: • irradiation • cancer • genetic damage • mutations to DNA / genes • radiation sickness / poisoning		1	AO3 4.4.3.3
Total			**8**	

Answer 96 · Mark scheme

November 2020 | 8463/1F | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	density = $\frac{\text{mass}}{\text{volume}}$ **or** $\rho = \frac{m}{V}$		1	AO1 4.3.1.1
10.2	$998 = \frac{\text{m}}{6\ 500\ 000}$ m = 998 × 6 500 000 m = 6 487 000 000 m = 6.487 × 10^9 (kg)	 allow a correct conversion of their calculated value of mass into standard form	1 1 1 1	AO2 4.3.1.1
10.3	energy transferred = power × time **or** $E = Pt$		1	AO1 4.2.4.2
10.4	t = 18 000 (s) **or** t = 5 × 60 × 60 E = 1.5 × 10^9 × 18 000 E = 2.7 × 10^{13} (J)	 allow a correct substitution using an incorrectly/not converted value of t allow a correct calculation using an incorrectly/not converted value of t	1 1 1	AO2 4.2.4.2
10.5	the variation in demand is (much) greater than 1.5 × 10^9 W demand remains high for longer than 5 hours	allow the increase in demand is greater than the (power) output of the (hydroelectric) power station allow 04:00 to 16:00 is 12 hours allow 04:00 to 16:00 is greater than 5 hours	1 1	AO3 4.1.3
Total			**11**	

Answer 97 · Mark scheme

November 2021 | 8463/1F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO/ Spec. Ref
06.1	(fixed) solar cells aren't always pointed (directly) at the Sun **or** (fixed) solar cells don't track the Sun (through the sky) (fixed) solar cells don't (always) receive maximum intensity of solar radiation	 allow solar cells won't receive as much (solar) energy allow solar cells won't generate as much electricity	1 1	AO3 4.1.3
06.2	Q = 3.5 × 3600 Q = 12 600 (C)		1 1	AO2 4.2.1.2
06.3	efficiency = $\frac{\text{useful power output}}{\text{total power input}}$		1	AO1 4.1.2.2
06.4	0.16 = $\frac{\text{useful power output}}{7500}$ useful power output = 0.16 × 7500 useful power output = 1200 (W)		1 1 1	AO2 4.1.2.2
06.5	the energy becomes less useful		1	AO1 4.1.2.1
06.6	a very large area would need to be covered with solar cells		1	AO3 4.1.3
Total			**10**	

Question 10

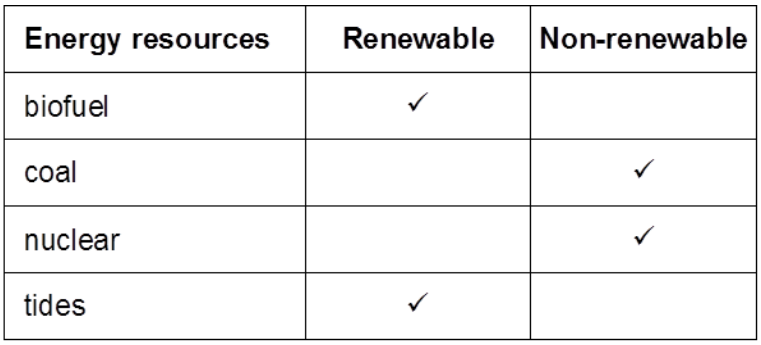
Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	nuclei decreases	do not accept atoms	1 1	AO1 4.4.4.2
10.2	m = 0.004 (kg) E = 0.004 × 5200 × 50 000 000 E = 1.04 × 10^9 (J) **or** E = 1 040 000 000 (J)	 allow a correct substitution of an incorrectly/not converted value of m allow a correct calculation using an incorrectly/not converted value of m	1 1 1	AO2 4.3.2.2 4.1.1.3
10.3	any **two** from: • to make sure the fusion process is possible • to develop an understanding of the process • to make adaptations to the process • to assess the efficiency of the process • to make predictions • assess safety risks • to assess environmental impact • set-up cost is lower (for small scale experiments)		2	AO3 4.1.3

10.4	releases carbon dioxide which causes global warming **OR** releases particulates which causes global dimming **or** which causes breathing problems **OR** releases sulfur dioxide which causes acid rain **OR** releases nitrogen oxides which causes breathing problems **or** which causes acid rain	allow releases greenhouse gases allow which causes climate change	1 1	AO1 4.1.3
Total			**9**	

Answer 99 · Mark scheme

June 2022 | 8463/1F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	 4 correct scores **2** marks 3 correct scores **1** mark		2	AO1 4.1.3

Energy resources	Renewable	Non-renewable
biofuel	✓	
coal		✓
nuclear		✓
tides	✓	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	potential difference current energy potential difference	this order only allow p.d.	1 1 1 1	AO1 4.2.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	charge flow = current × time **or** $Q = It$		1	AO1 4.2.1.2

4.1.3 National and global energy resources

Answer 99 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	t = 300 (s)		1	AO2
	Q = 130 000 × 300	allow a correct substitution using an incorrectly / not converted value of t	1	AO2
	Q = 39 000 000 ***or*** $Q = 3.9 \times 10^7$	allow a correct calculation using an incorrectly / not converted value of t	1	AO2
	coulombs / C		1	AO1 4.2.1.2

Total Question 7		**11**

Answer 100 · Mark scheme

June 2022 | 8463/1F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	*P* = 696 000 000 (W) *P* = 1200 (W)	 allow an answer consistent with their incorrectly / not converted value of *P*	1 1	AO2 4.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	any **2** from: • wind is unreliable • wind turbines don't turn when the wind is too strong/weak • there are not enough wind turbines (in the UK)	 allow it was not windy (on that day) allow some wind turbines may be offline for maintenance allow energy from wind may not be enough (to generate 34 000 MW) ignore weather conditions unqualified	2	AO2 4.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	the efficiency would increase because the percentage / proportion / amount of energy usefully transferred would increase **or** because the percentage / proportion / amount of energy wasted would decrease (because) less (work is done against) friction	 ignore more electricity generated allow less energy wasted	1 1 1	AO3 AO1 AO1 4.1.2.1 4.1.2.2

4.1.3 National and global energy resources

Answer 100 · Mark scheme June 2022 | 8463/1F | Original Q9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	more efficient devices waste less energy **or** more efficient devices need a lower energy input (for the same energy output)	ignore use less electricity	1	AO3 4.1.2.2 4.1.3
	which would minimise the electricity / energy demand **or** which would minimise the environmental impact from (fossil fuel) electricity generation	allow less electricity needs to be generated allow lower energy / electricity bill allow examples of environmental impact e.g. lower CO_2 emissions ignore 'better for the environment' unless qualified ignore answers that discuss 'saving energy' unless qualified ignore answers that discuss alternative methods of generating electricity	1	

Total Question 9		**9**

4.1.3 National and global energy resources

Answer 101 · Mark scheme

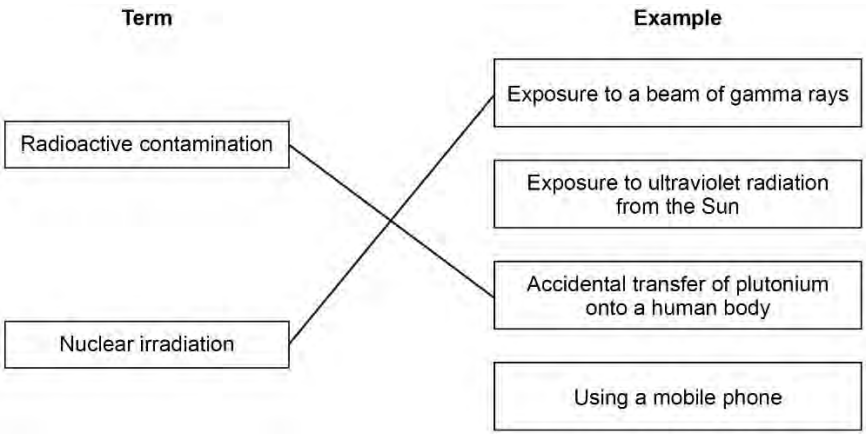
June 2023 | 8463/1F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	protons neutrons	this order only	1 1	AO1 4.4.1.2

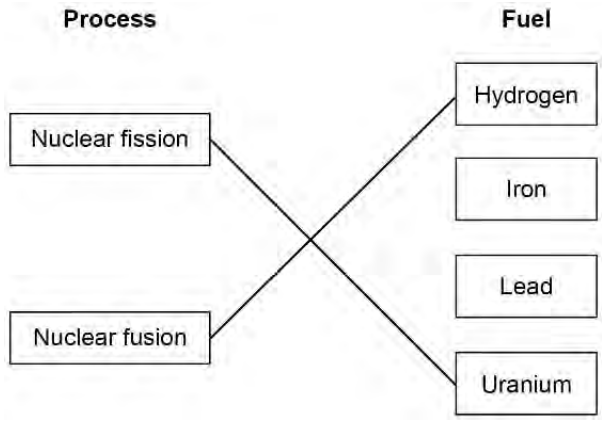
Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	the time taken for half the nuclei in a sample to decay		1	AO1 4.4.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	carbon-18		1	AO3 4.4.2.3

Question	Answers	Mark	AO / Spec. Ref.
03.4	 1 mark for each correct line additional line from a box on the left negates the mark for that box	1 1	AO1 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	to remove radioactive dust from their shoes		1	AO3 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	number of days = $\frac{0.072}{0.00050}$ number of days = 144		1 1	AO2 4.4.3.1

Question	Answers	Mark	AO / Spec. Ref.
03.7	 1 mark for each correct line additional line from a box on the left negates the mark for that box	1 1	AO1 4.4.4.1 4.4.4.2

Total Question 3	11

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	other energy resources = 95 (%) hydroelectric = 5 (%)		1 1	AO2 4.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	E_p = 2 500 000 × 9.8 × 15 E_p = 367 500 000 (J) **or** E_p = 3.675 × 10^8 (J)	 allow 370 000 000 (J) **or** E_p = 3.7 × 10^8 (J)	1 1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	energy = power × time **or** $E = P \times t$		1	AO1 4.2.4.2 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	t = 3600 (s) E = 3000 × 3600 E = 10 800 000 (J) **or** E = 1.08 × 10^7 (J)	 allow a correct substitution using an incorrectly/not converted value for t allow an answer consistent with their incorrectly/not converted value for t allow a correct answer given to 2 s.f.	1 1 1	AO2 4.2.4.2 4.1.1.4

4.1.3 National and global energy resources

Answer 102 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	the level of the water in the river varies **or** the amount of rainfall varies		1	AO3 4.1.3
	and is lower in the summer months	allow specified months or range of months eg April to September MP2 dependent on scoring MP1	1	

Total Question 4	**10**

Answer 103 · Mark scheme

June 2024 | 8463/1F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	thermal / internal (energy) **or** kinetic (energy of the water particles)	ignore heat allow E_k	1	AO1 4.1.1.1 4.3.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	gravitational potential (energy)	allow E_p / GPE allow kinetic / E_k	1	AO1 4.1.1.1

Question	Answers	Mark	AO / Spec. Ref.
09.3	**Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted.	3–4	AO3 4.1.1.1 4.3.2.1 4.1.1.2 4.1.2.2 4.1.3
	Level 1: Relevant features are identified and differences noted.	1–2	
	No relevant content	0	
	Indicative content **Method A:** • heated water needs insulating (to maintain high temperature) • energy stored by heating water is much greater (per 100 kg) • useful energy from heating 100 kg of water = 20 160 (kJ) • energy wasted (per 100 kg) = 13 440 (kJ) • efficiency = 60 % **Method B:** • suitable location needed to pump water uphill • pumping water efficiency is higher • useful energy from pumping 100 kg of water = 367.5 (kJ) • energy wasted (per 100kg) = 122.5 (kJ) • efficiency = 75 % A level 2 answer should use the data in a relevant calculation that compares the two methods.		

4.1.3 National and global energy resources

Answer 103 · Mark scheme

June 2024 | 8463/1F | Original Q9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	**Transport examples:** don't use (petrol / diesel) cars (for transport) **or** don't burn petrol / diesel (for transport) (instead) use electric cars **or** (instead) use hydrogen-fuelled cars **or** (instead) use a bicycle **or** (instead) use public transport **or** (instead) walk **Generating Electricity examples:** don't use coal / oil / gas (to generate electricity) (instead) use renewable methods **or** (instead) use nuclear power **OR** don't use (electrical) appliances when not needed to reduce the demand for electricity (generated) using coal / oil / gas	allow don't use other transport methods e.g. (diesel) buses allow fossil fuels for petrol / diesel allow fossil fuels for coal / oil / gas allow specific examples of renewable energy resources allow specific examples e.g. lights allow fossil fuels for coal / oil / gas accept other reasonable changes with valid alternative for 2 marks each	1 1 1 1	AO3 4.1.3

Total Question 9	10

Answer 104 · Mark scheme

June 2024 | 8463/1F | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	nuclei neutrons gamma rays	this order only	1 1 1	AO1 4.4.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2	energy = power × time **or** $E = P \times t$		1	AO1 4.2.4.2 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	P = 500 000 000 (W) E = 500 000 000 × 3600 E = 1 800 000 000 000 (J) **or** $E = 1.8 \times 10^{12}$ (J)	 allow a correct substitution of an incorrectly / not converted value of P allow an answer consistent with an incorrectly / not converted value of P	1 1 1	AO2 4.2.4.2 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.4	any **one** from: • bury the radioactive waste • put the radioactive waste in cooling ponds • transport the radioactive waste in secure vessels • store the radioactive waste in metal containers • cover the radioactive waste in concrete	allow store it for (at least) one half-life ignore references to high / medium / low level waste ignore label the waste as hazardous	1	AO3 4.4.2.4

4.1.3 National and global energy resources

Answer 104 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.5	number of days = $\frac{92}{100} \times 365$		1	AO2 4.1.3
	number of days = 335.8	allow answers of 335 and 336 days allow an answer of 29.2 (days) for 1 mark	1	

Total Question 10	**10**

4.1.3 National and global energy resources

Answer 105 · Mark scheme

June 2025 | 8463/1F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	global warming		1	AO1 4.1.3

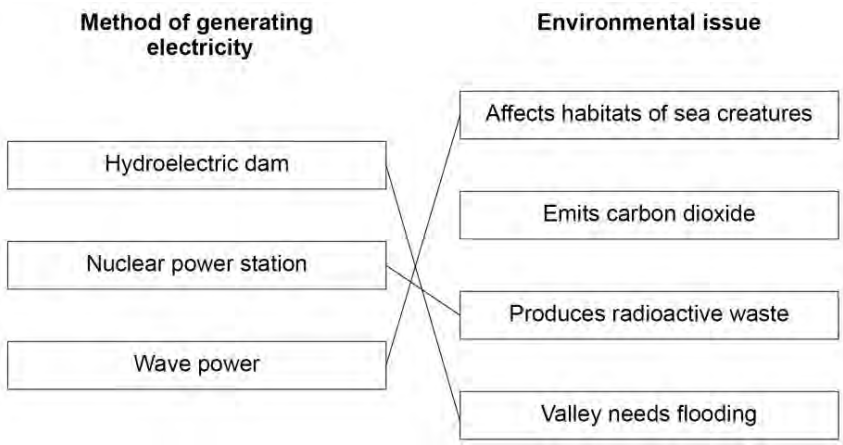
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	6000 (kg)		1	AO3 4.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	(as the distance travelled increases the amount of carbon dioxide) increases		1	AO3 4.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	electric cars are powered by a battery		1	AO1 4.1.3

4.1.3 National and global energy resources

Answer 105 · Mark scheme

Question	Answers	Mark	AO / Spec. Ref.
01.5	 do **not** accept more than one line from a box on the left	1 1 1	AO1 4.1.3

Total Question 1	**7**

Answer 106 · Mark scheme

June 2025 | 8463/1F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	renewable: (an energy resource that is) replenished *(*as it is used*)* non-renewable: (an energy resource that is) finite	allow replaced for replenished ignore has an infinite supply ignore not running out allow limited supply ignore running out ignore won't last forever	1 1	AO1 4.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	density = $\frac{\text{mass}}{\text{volume}}$ **or** $\rho = \frac{m}{V}$		1	AO1 4.3.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	$1030 = \frac{824\,000}{V}$ $V = \frac{824\,000}{1030}$ $V = 800\ (m^3)$		1 1 1	AO2 4.3.1.1

4.1.3 National and global energy resources

Answer 106 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	any **two** from: • at very low flow speeds there is no power output • tidal power output is (always) greater than wind power output for the same flow speeds (above 0.25 m/s) • a change in flow speed makes a bigger difference to tidal power output than wind power output • there is a non-linear relationship between flow speed and power output	allow wind power needs a higher flow speed to get the same power output (as tidal power) ignore reference to exponential relationships do **not** accept flow speed of tidal is less than flow speed of wind ignore comments about reliability or efficiency	2	AO3 4.1.3

Answer 106 · Mark scheme

June 2025 | 8463/1F | Original Q8

Question	Answers	Mark	AO / Spec. Ref.
08.5	**Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO3 4.1.3
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content • wind turbine is much larger than the tidal turbine • wind turbine causes more visual pollution than the tidal turbine • tidal turbine is hidden from view (as it is under water) • tidal turbine is less likely to cause noise pollution (as it is under water) • wind turbine is likely to make more noise • wind turbine needs more raw materials (for construction) • more wind turbines needed for same power output (at the same flow speed) • wind turbine will harm birds, whereas tidal turbine will not • tidal turbine may harm fish, whereas wind turbine will not		

Total Question 8	12

GCSE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Physics Specification B
3451/F

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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4.1.3 National and global energy resources

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GCSE PHYSICS

INFORMATION FOR EXAMINERS

1. General

The mark scheme for each question shows:

- the marks available for each part of the question;
- the total marks available for the question;
- the typical answer or answers which are expected;
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.)

3. Marking points

3.1 Marking of Quality of Written Communication

Where *Quality of written communication* appears in the mark scheme, one mark is to be awarded for either of the following points:

- Using correct scientific terms
- Correct sequencing or linking of ideas or points

The mark scheme will specify which of the points is to be awarded in a particular question. A QoWC mark can be awarded for a scientific answer, even if it is not accurate. It cannot be awarded for a nonsensical or non-scientific answer.
On the script, the QoWC tick should be identified by a 'q' written next to it.

3.2 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

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Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.3 Use of chemical symbols/formulae

If a candidate writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.4 The marking of quantitative relationships

Full credit can be given for a correct quantitative relationship expressed in:

- named units;
- physical quantities;
- standard symbols;
- a combination of physical quantities and units.

No credit can be given for any quantitative relationship expressed in terms of:

- a combination of physical quantities, units and symbols;
- a diagram, e.g. the ohm's law triangle, unless the rest of the answer shows clearly that the candidate understands the relationships involved.

3.5 Marking procedure for calculations

3.5.1 Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.
However:

- if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column;
- if the answer is correct, but an incorrect relationship is written in the working, then no marks can be awarded (see 3.5.2).

3.5.2 Where calculations are based on incorrectly recalled relationships, neither the incorrectly recalled relationship, nor the resulting calculation based on the incorrect relationship, will be credited.

3.6 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

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3.7 Errors carried forward

There should be no error carried forward from a previous answer which has been based on wrong science. Any error in the answers to a structured question should be penalised once only.

Examples

(a) A candidate who calculates average speed using speed = time/distance **and** then proceeds to use this incorrect answer to calculate an acceleration based on the correct quantitative relationship should be given credit for the use of the correct acceleration relationship but none for either numerical answer.

(b) A candidate who incorrectly calculates average speed using speed = distance/time and then proceeds to use this incorrect value to calculate an acceleration based on the correct quantitative relationship, should be given credit for the use of both correct quantitative relationships **and** for the correct substitution and use of the incorrect value in the calculation of the rate of acceleration.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.8 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.9 Brackets

(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.10 Interpretation of marginal points

There will be times when the answer is almost, but not quite, correct. Some examiners would award a mark while others would not. In any one script, an attempt should be made to balance these nearly correct answers by giving the mark on some occasions but not on others. If this is not done, the marking would end up being too lenient or too harsh.

3.11 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

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4.1.3 National and global energy resources

GCSE Physics
Foundation Tier 3451/F

3451F Q1

question	answers	extra information	mark
(a)	comet	correct order only	1
	elliptical		1
	Milky Way		1
	Universe		1
(b)(i)	D A C B	allow **2** marks for two letters in the correct place allow **1** mark for one letter in the correct place	3
(ii)	A		1
total			8

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4.1.3 National and global energy resources

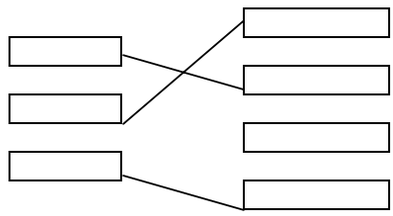
3451F Q2

question	answers	extra information	mark
(a)	95		1
(b)	alpha	accept correct symbol	1
(c)	any **two** from: • radiation is outside the body • radiation will not reach (living) cells • radiation absorbed by the air	 accept detector is on ceiling or high up the wall accept radiation cannot pass through the body / skin accept cannot pass through the plastic casing do **not** accept because it is alpha radiation – unless qualified do **not** accept does not give off harmful substance do **not** accept cannot pass through building materials etc.	2
(d)	less (than)		1
total			5

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4.1.3 National and global energy resources

3451F Q3

question	answers	extra information	mark
(a)	generator	accept dynamo accept alternator	1
(b)(i)	1400	ignore units	1
(ii)	0.3 or 30%	any incorrect unit penalise **1** mark allow **1** mark for the correct use of 600 **or** 0.3% **or** 30	2
(c)	**1** mark for each correct link 	if more than 3 lines are drawn, mark only 3 lines starting with those that are incorrect	3
(d)(i)	110	no tolerance	1
(ii)	12	no tolerance	1
(iii)	wind speed may be too low to operate the generator	accept wind may not always blow accept power depends on wind speed accept does not generate if wind speed is too high accept does not generate if wind speed is above 12 (m/s) accept does not generate if wind speed is below 1.6 (m/s) accept it is unreliable do **not** accept answers referring to cost only	1
total			10

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4.1.3 National and global energy resources

3451F Q4

question	answers	extra information	mark
(a)	B E A D	allow **1** mark for each letter in the correct place, to a maximum of **3** marks	3
(b)	(a spark) may cause the (petrol vapour) to explode / ignite	accept petrol for (petrol vapour) accept catch fire for explode	1
	connect tanker to earth with a (conducting) wire / chain **or** earth the tanker	accept ground for earth	1
(c)	**Quality of written communication**	for a logical sequence	1
	any **two** from:		2
	• when current greater than fuse rating / value	accept when current too great for appliance do **not** accept 'if there is too much current' do **not** accept voltage or electricity	
	• fuse (becomes hot and) melts / burns out	accept fuse blows / breaks	
	• circuit is broken	accept circuit switched off this cannot score credit on its own	
total			8

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4.1.3 National and global energy resources

3451F Q5

question	answers	extra information	mark
(a)(i)	crust		1
(ii)	inner core is <u>solid</u> outer core is liquid	do **not** accept just rock inner core is denser / hotter than outer core gets **2** marks accept one is solid and one is liquid for **1** mark accept they are different densities for **1** mark wrong way round = **0** marks	1 1
(b)	seismograph		1
(c)	difficult to measure (slow) movement (1) of plates (1) dependent mark **or** difficult to measure friction / forces (1) between plates (1) dependent mark		1 1
(d)	geothermal		1
(e)(i)	5000		1
(ii)	2500		1
total			9

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4.1.3 National and global energy resources

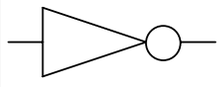
3451F Q6

	answers	extra information	mark
(a)	converging image object image object shorter		1 1 1 1 1 1
(b)(i)	(Earth's) gravity	accept centripetal accept minor misspellings, however, do **not** credit any response which could be 'centrifugal'	1
(ii)	to(wards) (the centre of the) Earth	allow inwards do **not** accept downwards	1
(c)(i)	**either** friction (force) **or** centripetal force between the tyres / wheels and (the surface of) the road	 allow grip allow on the tyres / wheels **or** towards the centre of the bend / arc / circle	 1 1
(ii)	mass **or** speed **or** momentum radius / diameter	allow weight allow velocity do **not** credit 'curvature' or 'circumference'	1 1
(d)	centripetal	accept minor misspellings (see above)	1
total			13

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4.1.3 National and global energy resources

3451F Q7

	answers	extra information	mark
(a)(i)	two switches in series **and** circuit complete	ignore small imperfections	1
(ii)	two switches in parallel **and** circuit complete	ignore small imperfections	1
(iii)	one switch in parallel with the cell / lamp (but **not** both)	ignore small imperfections	1
(iv)	(i) AND (ii) OR (iii) NOT	accept 'and' accept 'or' accept 'not'	1 1 1
(b)(i)	when it is light the sensor sends on / high / 1 signal to the gate off / low / 0 sent to the lamp **or** when it is dark the sensor sends off / low / 0 signal to the gate (1) on / high / 1 sent to the lamp (1)		1 1
(ii)	any suitable application	e.g. to switch a security light on (and off) e.g. to switch a light on when it is dark do **not** credit just '… to switch a light on / off'	1
(c)(i)		accept shading-in of either or both parts end connections are not required accept any orientation	1
(ii)	1 0 **or** 0 1 0 1 1 0	all correct	1
(iii)	truth (table)		1
total			12

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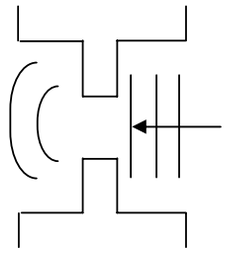
4.1.3 National and global energy resources

3451F Q8

question	answers	extra information	mark
(a)	60		1
(b)	$5\frac{1}{2}$ hours	must include unit	1
(c)	30		1
(d)	30 minutes or $\frac{1}{2}$ hour	must include unit	1
(e)	D **and** E	accept finish for E accept correct numbers from axes with units	1
	least steep part of the graph	accept covers smallest distance in a set time accept only moves 5 km in $1\frac{1}{2}$ hours (accept anything between 5 and 6) ignore horse is tired	1
total			6

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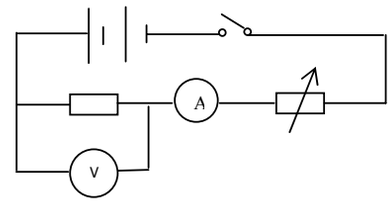
3451F Q9

question	answers	extra information	mark
(a)(i)	any **one** from: • (doctors) to see inside a patients body **or** endoscope • telephone cables • optical fibre / fibre optic lamps **or** (artificial) Christmas trees • data transfer **or** internet connection	 accept keyhole surgery do **not** accept flex **or** wires for cable accept decorative / ornamental lighting accept any feasible practical suggestion for taking light to a difficult to access place do **not** accept lighting unqualified do **not** accept lamp unqualified do **not** accept communications unless clarified	1
(ii)	(incident) ray angle greater than critical angle total internal reflection occurs	either order accept (incident) ray greater than 42° accept TIR do **not** accept just description of TIR	1 1
(b)(i)	waves shown diffracting in the correct direction 	ignore wavelength	1
(ii)	diffraction	accept diffract / diffracted	1
total			5

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4.1.3 National and global energy resources

3451F Q10

question	answers	extra information	mark
(a)	all symbols correct	 accept push switch symbol switch may be open or closed any lines through symbols = **0** marks	1
	correct circuit drawn voltmeter must be across resistor only	polarity of cells not relevant provided they are joined correctly two cells are required in the diagram ignore the order of the components allow small gaps in circuit omission of any component = **0** marks	1
(b)(i)	potential difference = current × resistance	accept voltage or p.d. for potential difference accept $V = I \times R$ accept  provided subsequent use correct do **not** accept C for current	1
(ii)	2	allow **1** mark for correct substitution wrong working loses both marks	2
(iii)	straight line drawn <u>through the origin</u> straight line passes through $I = 0.4, V =$ their (b)(ii) / 2 **and** 0.0	judge by eye this mark may be awarded if all points shown including these points are correct even if no line is drawn N.B. a curve scores **0** marks	1 1 dep
(c)	temperature <u>increases</u>	accept filament lamp / it gets <u>hotter</u> allow heat for temperature	1
total			8

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4.1.3 National and global energy resources

3451F Q11

question	answers	extra information	mark
(a)(i)	gamma rays	accept gamma accept correct symbol	1
(ii)	infra red	accept IR	1
(b)	ultraviolet <u>absorbed</u> by ink (energy) given out as light	 accept glows / luminous accept for **both** marks the ink is fluorescent do **not** accept answers in terms of uv being reflected	1 1
(c)	any **two** from: • UV can damage / kill / ionise / alter (normal) cells • change DNA structure **or** mutate • (normal) cells may become cancerous	 do **not** accept attacks cells **or** burns skin accept may cause (skin) cancer accept abnormal cell multiplication	2
(d)(i)	microwaves **and** infra red	both answers needed in either order do **not** accept heat for IR	1
(ii)	0.9	allow **1** mark for the <u>correct</u> use of 1.8 (kW) ($1.8 \times \frac{1}{2}$ or 1.8×30) i.e. adding the correct 2 power values	2
total			9

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4.1.3 National and global energy resources

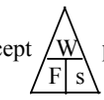
3451F Q12

question	answers	extra information	mark
(a)(i)	accelerating	accept getting faster accept speed / velocity increasing	1
(ii)	acceleration <u>increases</u>	accept velocity / speed increases <u>more</u> rapidly do **not** accept velocity / speed increases	1
(b)(i)	$\text{acceleration} = \frac{\text{change in velocity}}{\text{time (taken)}}$	accept $a = \frac{v - u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ do **not** accept velocity for change in velocity do **not** accept change in speed do **not** accept $a = \frac{v}{t}$	1
(ii)	15	allow **1** mark for an answer of 900 **or** for <u>correct</u> use of 540 seconds	2
(iii)	velocity includes direction	accept velocity is a vector (quantity) accept converse answer	1
(c)	force of gravity (between <u>shuttle</u> and Earth) plus correct orbital speed (makes <u>shuttle</u> move in a curve)	accept gravitational pull if used correctly accept forward motion **or** constant speed for orbital speed accept it is travelling fast enough accept for **2** marks the force of gravity provides the <u>centripetal</u> force	1 1
(d)	black is a good emitter of radiation **or** to limit the temperature rise inside the shuttle	accept heat for radiation accept the tiles are good insulation do **not** accept black absorbs heat on its own do **not** accept tiles are heat proof	1
total			9

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4.1.3 National and global energy resources

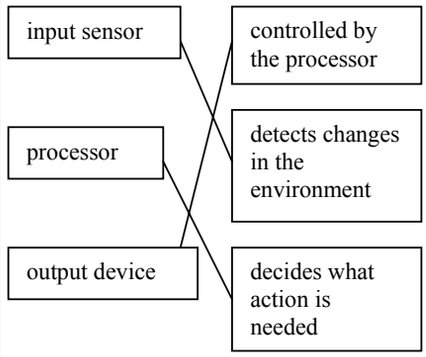
3451F Q13

question	answers	extra information	mark
(a)(i)	work (done) = force (applied) × distance (moved)	accept W = F × s or W = F × d accept  provided subsequent method is correct	1
(ii)	240 000 joules	allow **1** mark for correct substitution **or** correct use of 1200 (N) accept J do **not** accept j / Nm	2 1
(b)	800 (watts)	accept 0.8 kW accept their (a)(ii) ÷ 300 correctly evaluated for **2** marks allow **1** mark for correct substitution (a)(ii) ÷ 5 correctly evaluated for **1** mark	2
(c)(i)	any **one** from: • needs to raise the chair / lift • lifting more than one chair • energy transfer to the surroundings correctly qualified	 allow lifting more than 2 people implication of a heavier weight accept loss for transfer do **not** accept motor inefficient do **not** accept motor gets hot do **not** accept friction unless the location is specified as external to the motor	1
(ii)	electrical potential	accept electric **both** answers required for the mark	1
total			8

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4.1.3 National and global energy resources

3451F Q14

	answers	extra information	mark
(a)(i)	current		1
(ii)	resistance decreases	 accept 'the flow of electrons / current (through it) increases' for **1** mark do **not** credit just '… it will get warmer'	1 1
(b)		all pairs correct one pair correct for **1** mark	2
(c)(i)	potential divider	accept voltage divider	1
(ii)	4 (volts)	$6 \times \frac{30}{45}$ for **1** mark	2
(iii)	across the new resistor…(will) increase across R_2 … (will) decrease	 N.B. independent marks	1 1
total			10

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3451F Q15

	answers	extra information	mark
(a)	relay (normally open) (switch)	each mark is independent	1
	… switch on a (larger) current (in another circuit) **or** switch on a higher voltage circuit	do **not** accept switch on another circuit **or** smaller / equal current	1
	light emitting diode / LED	do **not** credit LDR	1
	… in one / direct / certain direction **or** from left to right	**or** when the cathode is connected to the negative terminal / side **or** when the left-hand side is connected to the positive terminal / side do **not** credit just '… is big enough' do **not** accept 'positive direction'	1
	AND gate	accept 'and' gate do **not** accept numerical values unless expanded	1
	… (both) inputs are on / high / 1 **or** current flows in both inputs		1
(b)	**Quality of written communication**	If in a sensible order which clearly indicates advantages or disadvantages, including answers in the form of a table **or** as bullet points Q ✓ Q X	1
	any **three** from: • advantage of mobile phones • drawback of mobile phones • benefit of the Internet • drawback of the Internet	e.g. more convenient for service engineers e.g. calls can be received away from base e.g. privacy can be more easily invaded e.g. drivers can be distracted e.g. microwaves / radio waves can / may cause damage to the brain e.g. access to educational material e.g. some material is salacious e.g. spam (on external e-mail) these are examples candidates may be credited for a variety of responses	3
total			10

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4.1.3 National and global energy resources

3451F Q16

question	answers	extra information	mark
(a)	**Y** and **Z**		1
	they have the same number of protons **or** same atomic number	accept they have the same number of electrons **or** same number of protons **and** electrons allow only different in number of neutrons N.B. independent marks	1
(b)	**Quality of written communication**	for correct use of terms underlined in B **or** C Q ✓ Q X	1
	A – alpha particle passes straight through the empty space of the atom **or** it is a long way from the nucleus B – alpha particle <u>deflected</u> / <u>repelled</u> / <u>repulsed</u> by the (positive) <u>nucleus</u>	describes 3 tracks correctly for **2** marks describes 2 or 1 track correctly for **1** mark	max 2
	C – alpha particle heading straight for the <u>nucleus</u> is <u>deflected</u> / <u>repelled</u> / <u>repulsed</u> backwards	do **not** accept hits the nucleus do **not** accept answers referring to refraction do **not** accept answers in terms of reflected backwards unless qualified in terms of repulsion mention of difference in charge on nucleus negates that track	
total			5

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GCSE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Science: Double Award
Specification B (Co-ordinated)
3462/3F

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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4.1.3 National and global energy resources

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SCIENCE: DOUBLE AWARD CO-ORDINATED

INFORMATION FOR EXAMINERS

1. General

The mark scheme for each question shows:

- the marks available for each part of the question;
- the total marks available for the question;
- the typical answer or answers which are expected;
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.)

3. Marking points

3.1 Marking of Quality of Written Communication

Where *Quality of written communication* appears in the mark scheme, one mark is to be awarded for either of the following points:

- Using correct scientific terms
- Correct sequencing or linking of ideas or points

The mark scheme will specify which of the points is to be awarded in a particular question. A QoWC mark can be awarded for a scientific answer, even if it is not accurate. It cannot be awarded for a nonsensical or non-scientific answer.
On the script, the QoWC tick should be identified by a 'q' written next to it.

3.2 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

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Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.3 Use of chemical symbols/formulae

If a candidate writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.4 The marking of quantitative relationships

Full credit can be given for a correct quantitative relationship expressed in:

- named units;
- physical quantities;
- standard symbols;
- a combination of physical quantities and units.

No credit can be given for any quantitative relationship expressed in terms of:

- a combination of physical quantities, units and symbols;
- a diagram, e.g. the ohm's law triangle, unless the rest of the answer shows clearly that the candidate understands the relationships involved.

3.5 Marking procedure for calculations

3.5.1 Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.
However:

- if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column;
- if the answer is correct, but an incorrect relationship is written in the working, then no marks can be awarded (see 3.5.2).

3.5.2 Where calculations are based on incorrectly recalled relationships, neither the incorrectly recalled relationship, nor the resulting calculation based on the incorrect relationship, will be credited.

3.6 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

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3.7 Errors carried forward

There should be no error carried forward from a previous answer which has been based on wrong science. Any error in the answers to a structured question should be penalised once only.

Examples

(a) A candidate who calculates average speed using speed = time/distance **and** then proceeds to use this incorrect answer to calculate an acceleration based on the correct quantitative relationship should be given credit for the use of the correct acceleration relationship but none for either numerical answer.

(b) A candidate who incorrectly calculates average speed using speed = distance/time and then proceeds to use this incorrect value to calculate an acceleration based on the correct quantitative relationship, should be given credit for the use of both correct quantitative relationships **and** for the correct substitution and use of the incorrect value in the calculation of the rate of acceleration.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.8 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.9 Brackets

(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.10 Interpretation of marginal points

There will be times when the answer is almost, but not quite, correct. Some examiners would award a mark while others would not. In any one script, an attempt should be made to balance these nearly correct answers by giving the mark on some occasions but not on others. If this is not done, the marking would end up being too lenient or too harsh.

3.11 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

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4.1.3 National and global energy resources

Double Award
Foundation Tier 3462/3F

3462/3F Q1

question	answers	extra information	mark
(a)	comet	correct order only	1
	elliptical		1
	Milky Way		1
	Universe		1
(b)(i)	D A C B	allow **2** marks for two letters in the correct place allow **1** mark for one letter in the correct place	3
(ii)	A		1
total			8

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4.1.3 National and global energy resources

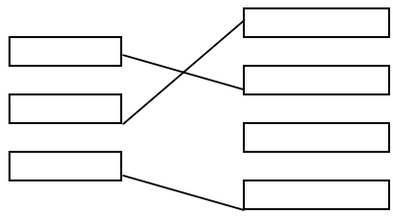
3462/3F Q2

question	answers	extra information	mark
(a)	95		1
(b)	alpha	accept correct symbol	1
(c)	any **two** from: • radiation is outside the body • radiation will not reach (living) cells • radiation absorbed by the air	 accept detector is on ceiling or high up the wall accept radiation cannot pass through the body / skin accept cannot pass through the plastic casing do **not** accept because it is alpha radiation – unless qualified do **not** accept does not give off harmful substance do **not** accept cannot pass through building materials etc.	2
(d)	less (than)		1
total			5

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4.1.3 National and global energy resources

3462/3F Q3

question	answers	extra information	mark
(a)	generator	accept dynamo accept alternator	1
(b)(i)	1400	ignore units	1
(ii)	0.3 or 30%	any incorrect unit penalise **1** mark allow **1** mark for the correct use of 600 **or** 0.3% **or** 30	2
(c)	**1** mark for each correct link 	if more than 3 lines are drawn, mark only 3 lines starting with those that are incorrect	3
(d)(i)	110	no tolerance	1
(ii)	12	no tolerance	1
(iii)	wind speed may be too low to operate the generator	accept wind may not always blow accept power depends on wind speed accept does not generate if wind speed is too high accept does not generate if wind speed is above 12 (m/s) accept does not generate if wind speed is below 1.6 (m/s) accept it is unreliable do **not** accept answers referring to cost only	1
total			10

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4.1.3 National and global energy resources

3462/3F Q4

question	answers	extra information	mark
(a)	B E A D	allow **1** mark for each letter in the correct place, to a maximum of **3** marks	3
(b)	(a spark) may cause the (petrol vapour) to explode / ignite	accept petrol for (petrol vapour) accept catch fire for explode	1
	connect tanker to earth with a (conducting) wire / chain **or** earth the tanker	accept ground for earth	1
(c)	**Quality of written communication**	for a logical sequence	1
	any **two** from:		2
	• when current greater than fuse rating / value	accept when current too great for appliance do **not** accept 'if there is too much current' do **not** accept voltage or electricity	
	• fuse (becomes hot and) melts / burns out	accept fuse blows / breaks	
	• circuit is broken	accept circuit switched off this cannot score credit on its own	
total			8

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4.1.3 National and global energy resources

3462/3F Q5

question	answers	extra information	mark
(a)(i)	crust		1
(ii)	inner core is <u>solid</u> outer core is liquid	do **not** accept just rock inner core is denser / hotter than outer core gets **2** marks accept one is solid and one is liquid for **1** mark accept they are different densities for **1** mark wrong way round = **0** marks	1 1
(b)	seismograph		1
(c)	difficult to measure (slow) movement (1) of plates (1) dependent mark **or** difficult to measure friction / forces (1) between plates (1) dependent mark		1 1
(d)	geothermal		1
(e)(i)	5000		1
(ii)	2500		1
total			9

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4.1.3 National and global energy resources

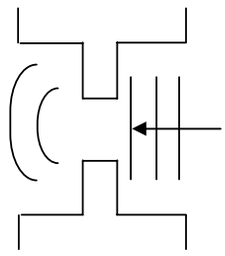
3462/3F Q6

question	answers	extra information	mark
(a)	60		1
(b)	$5\frac{1}{2}$ hours	must include unit	1
(c)	30		1
(d)	30 minutes or $\frac{1}{2}$ hour	must include unit	1
(e)	D **and** E least steep part of the graph	accept finish for E accept correct numbers from axes with units accept covers smallest distance in a set time accept only moves 5 km in $1\frac{1}{2}$ hours (accept anything between 5 and 6) ignore horse is tired	1 1
total			6

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4.1.3 National and global energy resources

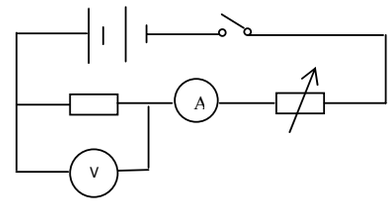
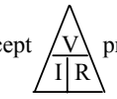
3462/3F Q7

question	answers	extra information	mark
(a)(i)	any **one** from: • (doctors) to see inside a patients body **or** endoscope • telephone cables • optical fibre / fibre optic lamps **or** (artificial) Christmas trees • data transfer **or** internet connection	 accept keyhole surgery do **not** accept flex **or** wires for cable accept decorative / ornamental lighting accept any feasible practical suggestion for taking light to a difficult to access place do **not** accept lighting unqualified do **not** accept lamp unqualified do **not** accept communications unless clarified	1
(ii)	(incident) ray angle greater than critical angle total internal reflection occurs	either order accept (incident) ray greater than 42° accept TIR do **not** accept just description of TIR	1 1
(b)(i)	waves shown diffracting in the correct direction 	ignore wavelength	1
(ii)	diffraction	accept diffract / diffracted	1
total			5

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4.1.3 National and global energy resources

3462/3F Q8

question	answers	extra information	mark
(a)	all symbols correct	 accept push switch symbol switch may be open or closed any lines through symbols = **0** marks	1
	correct circuit drawn voltmeter must be across resistor only	polarity of cells not relevant provided they are joined correctly two cells are required in the diagram ignore the order of the components allow small gaps in circuit omission of any component = **0** marks	1
(b)(i)	potential difference = current × resistance	accept voltage or p.d. for potential difference accept $V = I \times R$ accept  provided subsequent use correct do **not** accept C for current	1
(ii)	2	 allow **1** mark for correct substitution wrong working loses both marks	2
(iii)	straight line drawn <u>through the origin</u> straight line passes through $I = 0.4, V =$ their (b)(ii) / 2 **and** 0.0	judge by eye this mark may be awarded if all points shown including these points are correct even if no line is drawn N.B. a curve scores **0** marks	1 1 dep
(c)	temperature <u>increases</u>	accept filament lamp / it gets <u>hotter</u> allow heat for temperature	1
total			8

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4.1.3 National and global energy resources

3462/3F Q9

question	answers	extra information	mark
(a)(i)	gamma rays	accept gamma accept correct symbol	1
(ii)	infra red	accept IR	1
(b)	ultraviolet <u>absorbed</u> by ink (energy) given out as light	 accept glows / luminous accept for **both** marks the ink is fluorescent do **not** accept answers in terms of uv being reflected	1 1
(c)	any **two** from: • UV can damage / kill / ionise / alter (normal) cells • change DNA structure **or** mutate • (normal) cells may become cancerous	 do **not** accept attacks cells **or** burns skin accept may cause (skin) cancer accept abnormal cell multiplication	2
(d)(i)	microwaves **and** infra red	both answers needed in either order do **not** accept heat for IR	1
(ii)	0.9	allow **1** mark for the <u>correct</u> use of 1.8 (kW) $(1.8 \times \frac{1}{2}$ or $1.8 \times 30)$ i.e. adding the correct 2 power values	2
total			9

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4.1.3 National and global energy resources

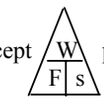
3462/3F Q10

question	answers	extra information	mark
(a)(i)	accelerating	accept getting faster accept speed / velocity increasing	1
(ii)	acceleration <u>increases</u>	accept velocity / speed increases <u>more</u> rapidly do **not** accept velocity / speed increases	1
(b)(i)	$\text{acceleration} = \frac{\text{change in velocity}}{\text{time (taken)}}$	accept $a = \frac{v - u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ do **not** accept velocity for change in velocity do **not** accept change in speed do **not** accept $a = \frac{v}{t}$	1
(ii)	15	allow **1** mark for an answer of 900 **or** for <u>correct</u> use of 540 seconds	2
(iii)	velocity includes direction	accept velocity is a vector (quantity) accept converse answer	1
(c)	force of gravity (between <u>shuttle</u> and Earth) plus correct orbital speed (makes <u>shuttle</u> move in a curve)	accept gravitational pull if used correctly accept forward motion **or** constant speed for orbital speed accept it is travelling fast enough accept for **2** marks the force of gravity provides the <u>centripetal</u> force	1 1
(d)	black is a good emitter of radiation **or** to limit the temperature rise inside the shuttle	accept heat for radiation accept the tiles are good insulation do **not** accept black absorbs heat on its own do **not** accept tiles are heat proof	1
total			9

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4.1.3 National and global energy resources

3462/3F Q11

question	answers	extra information	mark
(a)(i)	work (done) = force (applied) × distance (moved)	accept W = F × s or W = F × d accept  provided subsequent method is correct	1
(ii)	240 000 joules	allow **1** mark for correct substitution **or** correct use of 1200 (N) accept J do **not** accept j / Nm	2 1
(b)	800 (watts)	accept 0.8 kW accept their (a)(ii) ÷ 300 correctly evaluated for **2** marks allow **1** mark for correct substitution (a)(ii) ÷ 5 correctly evaluated for **1** mark	2
(c)(i)	any **one** from: • needs to raise the chair / lift • lifting more than one chair • energy transfer to the surroundings correctly qualified	 allow lifting more than 2 people implication of a heavier weight accept loss for transfer do **not** accept motor inefficient do **not** accept motor gets hot do **not** accept friction unless the location is specified as external to the motor	1
(ii)	electrical potential	accept electric **both** answers required for the mark	1
total			8

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4.1.3 National and global energy resources

3462/3F Q12

question	answers	extra information	mark
(a)	**Y** and **Z**		1
	they have the same number of protons **or** same atomic number	accept they have the same number of electrons **or** same number of protons **and** electrons allow only different in number of neutrons N.B. independent marks	1
(b)	**Quality of written communication**	for correct use of terms underlined in B **or** C Q ✓ Q X	1
	A – alpha particle passes straight through the empty space of the atom **or** it is a long way from the nucleus B – alpha particle deflected / repelled / repulsed by the (positive) nucleus C – alpha particle heading straight for the nucleus is deflected / repelled / repulsed backwards	describes 3 tracks correctly for **2** marks describes 2 or 1 track correctly for **1** mark do **not** accept hits the nucleus do **not** accept answers referring to refraction do **not** accept answers in terms of reflected backwards unless qualified in terms of repulsion mention of difference in charge on nucleus negates that track	max 2
total			5

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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Physics 3451/F
Specification B

Mark Scheme

2005 examination – June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Physics (Specification B)
Foundation Tier 3451/F

3451/F Q1

question	answers	extra information	mark
(a)(i)	less than	accept any correct indication	1
(ii)	more than	accept any correct indication	1
(b)	any **two** from: stays above the same place above the equator one orbit takes 24 hours	 do **not** accept stays in the same place do **not** accept goes around equator unless qualified do **not** accept orbit at same speed as Earth do **not** accept orbit at a constant speed accept has same angular speed / velocity as Earth	2
total			4

3451/F Q2

question	answers	extra information	mark
(a)	comet		1
(b)	large group / number / collection of stars	ignore reference to planets accept millions of stars do **not** accept thousands of stars do **not** accept loads of stars	1
(c)	giant supernova neutron		1 1 1
total			5

4.1.3 National and global energy resources

3451/F Q3

question	answers	extra information	mark
(a)(i)	radio		1
(ii)	gamma	accept microwave accept infrared	1
(iii)	ultra violet		1
(iv)	microwaves		1
(b)	the same as		1
(c)	X-rays do not go through lead	references to gamma rays are incorrect accept lead protects them from the X-rays accept not exposed to X-rays	1
	lead stops / reduces risk of X-rays harming / damaging / killing (persons) <u>cells</u>	accept X-rays (may) cause cancer accept organs for cell do **not** accept references to electric shock do **not** accept stops bones of people showing on X-ray answers involving the horse wearing an apron are incorrect	1
	Quality of written communication	award for a sensible sequence of **two** points	1
total			8

Physics B – AQA GCSE Mark Scheme, 2005 June series

3451/F Q4

question	answers	extra information	mark
(a)	light electrical		1 1
(b)	15% **or** 0.15	correct substitution gains **1** mark only an answer of 15 with no unit **or** an incorrect unit gains **1** mark an answer of 0.15 given with a unit gains **1** mark	2
(c)	the ticket machine is a long way from other electricity supplies		1
(d)	any figure between 5 and 10 inclusive	unit not required but if given must match numerical answer	1
total			6

3451/F Q5

question	answers	extra information	mark
(a)(i)	radon (gas)	do **not** accept gas	1
(ii)	background		1
(b)	bigger	accept any word which means bigger	1
(c)	**Z** alpha will not pass through aluminium or lead	if Z is not given, the reason does not score accept alpha cannot go through metals / dense material accept there is nothing to stop the radiation accept alpha will not pass through aluminium do **not** accept alpha will not pass through lead do **not** accept alpha stopped by air	1 1
total			5

4.1.3 National and global energy resources

3451/F Q6

question	answers	extra information	mark
(a)	loses negative charge / electrons	do **not** accept positive charge transfers to the comb do **not** accept friction	1
(b)	**A** attract		1
	B repel		1
	C attract		1
(c)	**F A D E**	allow **2** marks for 2 letters in the correct place allow **1** mark for 1 letter in the correct place	3
total			7

Physics B – AQA GCSE Mark Scheme, 2005 June series

3451/F Q7

question	answers	extra information	mark
(a)	all points correctly plotted	tolerance ± $\frac{1}{2}$ square on y axis only allow **1** mark for 3 correctly plotted points	2
	attempt made to draw a smooth curve	do **not** accept dot-to-dot line	1
(b)(i)	3 days ± 0.2 **or** any value correctly obtained using their graph line	if no line drawn in (a), answer must be exactly 3	1
(ii)	3 days or their (b)(i)		1
(c)	radon-222	accept radon **or** 222 accept alpha or 3.8 correct isotope required for reason to score	1
	has the shortest half-life	accept the others have longer half-lives	1
total			7

4.1.3 National and global energy resources

3451/F Q8

question	answers	extra information	mark
(a)	fossils of Cynognathus are found in Africa and South America		1
	the shapes ……. almost fit together	only two boxes should be ticked deduct **1** mark for each additional box to a minimum mark of **0**	1
(b)	continental		1
	crust		1
	tectonic		1
total			5

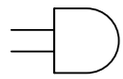
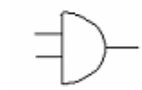
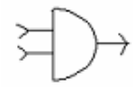
Physics B – AQA GCSE Mark Scheme, 2005 June series

3451/F Q9

question	answers	extra information	mark
(a)	capacitor LDR relay (normally open)	accept condenser **or** light dependent resistor accept 'ldr', 'Ldr' etc. do **not** accept 'relay normally closed'	1 1 1
(b)(i)	battery	accept '(battery of) cells' do **not** accept 'battery / cell'	1
(ii)	LED	**or** light emitting diode accept 'led' or 'Led' do **not** accept just 'diode'	1
(iii)	B will light (but C will not)	accept '(only) B will work' accept 'one is on the other is off' do **not** accept 'C is on and B is off'	1
(iv)	any **one** from: B is connected the right way round (and C is not) a (light emitting) diode only allows (a significant) current to flow in one direction B's anode is connected to the positive side of the supply B's cathode is connected to the negative terminal	N.B. the candidate's answer to part (b)(iii) may include this mark but do **not** credit if the response to part (b)(iii) is incorrect or there is any other contradiction if (iv) is completely consistent with (iii) which is wrong, allow **1** mark	1
(c)(i)	first input / second input / output 0 / 0 / **0** 1 / 0 / **0** 0 / 1 / **0** 1 / 1 / **1**	**all** correct allow: OFF NO OFF NO OFF NO ON YES	1
(ii)	truth (table)		1

cont…

3451/F Q9 cont…

(iii)		a Roman upper case D in any orientation without contacts is acceptable but if contacts are shown do **not** give the mark if there is any ambiguity or contradiction allow  	1
(d)	light sensor	**or** light dependent resistor **or** LDR accept 'ldr', Ldr' etc allow solar cell, photo cell	1
	NOT gate	accept 'Not gate' **or** 'not gate' if both correct but in the wrong order credit with **1** mark	1
total			12

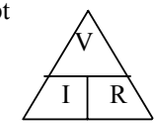
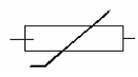
4.1.3 National and global energy resources

3451/F Q10

question	answers	extra information	mark
(a)(i)	rays continued to meet on the right hand side of the lens and beyond	must be straight lines from the right hand side of the lens ignore details through the lens allow if no arrows	1
	meet exactly on the axis	negate mark if contradictory arrow(s) added do not need to go beyond the focus for this mark	1
(ii)	(principal) focus	**or** focal (point)	1
(iii)	converging	**or** convex	1
(b)(i)	**A**		1
(ii)	rays seem to come from this point	**or** words to this effect **or** shows this on the diagram	1
(iii)	diverging	**or** concave	1
(c)	film	accept any unambiguous method of showing the correct response	1
	smaller than		1
	further away from		1
(d)	any **three** from: • real image can be put on a screen • virtual image cannot be put on a screen / film • virtual image is imaginary • real image is formed where (real) rays cross / converge • virtual image is where virtual / imaginary rays (seem to) come from • virtual image formed where virtual rays intersect / cross	allow film allow real image has light travelling through it **or** virtual image is where rays seem to come from	3
total			13

4.1.3 National and global energy resources

3451/F Q11

question	answers	extra information	mark
(a)(i)	$A_1 = 0.5$	ignore any units	1
	$A_4 = 0.5$	allow **1** mark for $A_1 = A_4 \neq 0.5$	1
(ii)	the resistance of **P** is more than 20 Ω		1
	a smaller current goes through P / A_2 (than 20 Ω)	dependent on getting 1st mark correct accept converse	1
(b)(i)	potential difference = current × resistance	accept pd / voltage for potential difference accept V = I × R, correct symbols and correct case only accept volts = amps × ohms accept  provided subsequent method is correct allow combination of physical quantities and named units allow voltage = I × R	1
(ii)	6	allow **1** mark for correct substitution	2
(iii)	6	accept their (b)(ii)	1
(c)	<u>thermistor</u> or 	accept correct circuit symbol allow phonetic spelling	1
	<u>resistance</u> goes down (as temperature of thermistor goes up)	do **not** accept changes for goes down do **not** accept an answer in terms of current only answers in terms of other components are incorrect	1
total			10

Physics B – AQA GCSE Mark Scheme, 2005 June series

3451/F Q12

question	answers	extra information	mark
(a)(i)	larger the distance, greater the time	accept 'they are proportional' accept converse	1
(ii)	any value between 6 and 9 years inclusive		1
(b)(i)	carbon dioxide		1
(ii)	(Venus) has high**er** temperature (than Mercury)	accept has the high**est** temperature accept Venus is hotter / hottest do **not** accept has a high / very high temperature	1
	(Venus) further from the Sun than Mercury	accept 'Venus is not the closest planet to the Sun' answer in terms of greenhouse effect only, scores **0** marks	1
total			5

4.1.3 National and global energy resources

3451/F Q13

question	answers	extra information	mark
(a)(i)	20		1
(ii)	convection		1
(iii)	fit draughtproof strips	accept lay carpet accept fit curtains accept close doors / windows / curtains accept any reasonable suggestion for reducing a draught 'double glazing' alone is insufficient	1
(b)	air is (a good) insulator **or** air is a poor conductor	accept air cavity / 'it' for air	1
	reducing heat transfer by <u>conduction</u>	accept stops for reduces ignore convection do **not** accept radiation do **not** accept answers in terms of heat being trapped	1
(c)(i)	most cost effective	accept it is cheaper or low<u>est</u> cost accept shortest payback time accept in terms of reducing heat loss by the largest amount do **not** accept it is easier ignore most heat is lost through the roof	1
(ii)	4		1
total			7

4.1.3 National and global energy resources

Physics B – AQA GCSE Mark Scheme, 2005 June series

3451/F Q14

question	answers	extra information	mark
(a)(i)	constant speed	do **not** accept normal speed do **not** accept it is stopped / stationary	1
	in a straight line	accept any appropriate reference to a direction constant velocity gains **2** marks 'not accelerating' gains **2** marks terminal velocity alone gets **1** mark	1
(ii)	goes down owtte	accept motorbike (it) slows down	1
(b)(i)	20 (m/s)	ignore incorrect units	1
(ii)	acceleration = change in velocity / time (taken)	do **not** accept velocity for change in velocity accept change in speed accept $a = \frac{v-u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ **or** a = $\frac{\Delta v}{t}$ do **not** accept $a = \frac{v}{t}$	1
(iii)	4 **or** their (b)(i) ÷ 5	allow **1** mark for correct substitution	2
	m/s^2	m/s/s **or** ms^{-2} **or** metres per second squared **or** metres per second per second	1
(c)	vehicle may skid / slide	loss of control / brakes lock / wheels lock accept greater stopping distance **or** difficult to stop	1
	due to reduced friction (between tyre(s) and road)	accept due to less grip do **not** accept no friction	1

cont…

3451/F Q14 cont…

(d)	any **three** from: • increased speed • reduced braking force • slower (driver) reactions • poor vehicle maintenance • increased mass / weight of vehicle • poor road surface • more streamlined	do **not** accept night time / poor vision N.B. specific answers may **each** gain credit eg tiredness (1), drinking alcohol (1), using drugs (1), driver distracted (1) etc specific examples may **each** gain credit eg worn brakes or worn tyres etc accept large mass / weight of vehicle if candidates give three answers that affect stopping distance but not specific to increase award **1** mark only	3
total			13

4.1.3 National and global energy resources

Physics B – AQA GCSE Mark Scheme, 2005 June series

3451/F Q15

question	answers	extra information	mark
(a)(i)	arrow from centre of the ball **and** at right angles to the string **and** in the correct direction	arrow should point to the student's belt accept free-hand 'straight' line do **not** accept curved line	1
(ii)	increase increase increase	accept 'be stronger / bigger' accept 'be stronger / bigger' accept 'be stronger / bigger'	1 1 1
(b)	speed velocity direction	all **three** correct any two correct for **1** mark otherwise **0** marks	2
(c)(i)	centripetal	accept 'centripedal' and other minor misspellings do **not** accept anything which could be 'centrifugal'	1
(ii)	gravity	accept 'weight' accept 'force of attraction due to mass(es) (of the Moon and the Earth)'	1
(iii)	electron(s)		1
(iv)	electrostatic	accept 'electrical' do **not** accept just 'centripetal'	1
total			10

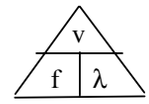
4.1.3 National and global energy resources

3451/F Q16

question	answers	extra information	mark
(a)(i)	**X** at the centre of the lifebelt	measuring from the centre of **X**, allow 2 mm tolerance in any direction	1
(ii)	any **two** from: below the point of suspension at the centre (of the lifebelt) (because) the lifebelt / it is symmetrical	if X is on vertical line below the hanger (but not at centre) can gain the first point only accept '(vertically) below **Y**' accept 'in the middle' **or** (because) the mass / weight is evenly distributed	2
(b)	Nm **or** newton metre(s) 750	accept Newton metre(s) do **not** accept any ambiguity in the symbol ie NM, nM or nm (moment) = force × (perpendicular) distance (between line of action and pivot) **or** (moment) = 500 × 1.5 gains **1** mark	1 2
(c)	**Quality of written communication**: any **three** connected points from: low(er) <u>centre of mass / gravity</u> (more) <u>stable</u> less likely to fall over the <u>turning effect / moment</u> (of the weight of case) is less so the pull on her arm is less	for **2** of the underlined terms used in the correct context **or** <u>centre of mass / gravity</u> will be close(r) to the wheels / axle / ground **or** less <u>unstable</u> accept 'less likely to overturn' do **not** accept 'will not fall over' **or** so less effort is needed to hold the case ignore references to pulling the case	1 3
total			10

4.1.3 National and global energy resources

3451/F Q17

question	answers	extra information	mark
(a)	any **two** from: • **amplitude** decreasing • **wavelength** increasing • **frequency** decreasing **Quality of written communication**	accept siren / sound getting quieter do **not** accept sound decreases accept pitch decreasing ignore reference to transverse wave ignore reference to speed contradictory statements within each point lose the mark all emboldened terms in candidate's answer used correctly	2 1
(b)(i)	ultrasound **or** ultrasonic		1
(ii)	wave speed = frequency × wavelength	accept speed / velocity for wave speed accept $v = f \times \lambda$ do **not** accept w for λ do **not** accept s for v accept  provided subsequent calculation shows a correct method	1
(iii)	339.2 **or** 340 **or** 339	allow **1** mark for using 212 000 allow **1** mark for correct substitution an answer of 0.3392 **or** 0.34 **or** 0.339 gains **1** mark only award full credit for a correct numerical answer with the unit changed to km/s	3
total			8

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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science: Double Award 3462/3F
Specification B (Co-ordinated)

Mark Scheme

2005 examination - June series

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Double Award
Foundation Tier 3462/3F

3462/3F Q1

question	answers	extra information	mark
(a)(i)	less than	accept any correct indication	1
(ii)	more than	accept any correct indication	1
(b)	any **two** from: stays above the same place above the equator one orbit takes 24 hours	 do **not** accept stays in the same place do **not** accept goes around equator unless qualified do **not** accept orbit at same speed as Earth do **not** accept orbit at a constant speed accept has same angular speed / velocity as Earth	2
total			4

3462/ 3F Q2

question	answers	extra information	mark
(a)	comet		1
(b)	large group / number / collection of stars	ignore reference to planets accept millions of stars do **not** accept thousands of stars do **not** accept loads of stars	1
(c)	giant supernova neutron		1 1 1
total			5

4.1.3 National and global energy resources

3462/3F Q3

question	answers	extra information	mark
(a)(i)	radio		1
(ii)	gamma	accept microwave accept infrared	1
(iii)	ultra violet		1
(iv)	microwaves		1
(b)	the same as		1
(c)	**Quality of written communication**	award for a sensible sequence of **two** points	1
	X-rays do not go through lead	accept lead protects them from the X-rays accept not exposed to X-rays	1
	lead stops / reduces risk of X-rays harming / damaging / killing (persons) <u>cells</u>	accept X-rays (may) cause cancer accept organs for cell do **not** accept references to electric shock do **not** accept stops bones of people showing on X-ray answers involving the horse wearing an apron are incorrect references to gamma rays are incorrect	1
total			8

4.1.3 National and global energy resources

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q4

question	answers	extra information	mark
(a)	light electrical		1 1
(b)	15% **or** 0.15	correct substitution gains **1** mark only an answer of 15 with no unit **or** an incorrect unit gains **1** mark an answer of 0.15 given with a unit gains **1** mark	2
(c)	the ticket machine is a long way from other electricity supplies		1
(d)	any figure between 5 and 10 inclusive	unit not required but if given must match numerical answer	1
total			6

4.1.3 National and global energy resources

3462/3F Q5

question	answers	extra information	mark
(a)(i)	radon (gas)	do **not** accept gas	1
(ii)	background		1
(b)	bigger	accept any word which means bigger	1
(c)	**Z** alpha will not pass through aluminium or lead	if Z is not given, the reason does not score accept alpha cannot go through metals / dense material accept there is nothing to stop the radiation accept alpha will not pass through aluminium do **not** accept alpha will not pass through lead do **not** accept alpha stopped by air	1 1
total			5

4.1.3 National and global energy resources

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q6

question	answers	extra information	mark
(a)	loses negative charge / electrons	do **not** accept positive charge transfers to the comb do **not** accept friction	1
(b)	**A** attract		1
	B repel		1
	C attract		1
(c)	**F A D E**	allow **2** marks for 2 letters in the correct place allow **1** mark for 1 letter in the correct place	3
total			7

3462/3F Q7

question	answers	extra information	mark
(a)	all points correctly plotted	tolerance ± $\frac{1}{2}$ square on y axis only allow **1** mark for 3 correctly plotted points	2
	attempt made to draw a smooth curve	do **not** accept dot-to-dot line	1
(b)(i)	3 days ± 0.2 **or** any value correctly obtained using their graph line	if no line drawn in (a), answer must be exactly 3	1
(ii)	3 days or their (b)(i)		1
(c)	radon-222	accept radon **or** 222 accept alpha or 3.8 correct isotope required for reason to score	1
	has the shortest <u>half-life</u>	accept the others have longer <u>half-lives</u>	1
total			7

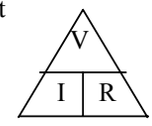
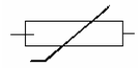
4.1.3 National and global energy resources

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q8

question	answers	extra information	mark
(a)	fossils of Cynognathus are found in Africa and South America		1
	the shapes ……. almost fit together	only two boxes should be ticked deduct **1** mark for each additional box to a minimum mark of **0**	1
(b)	continental		1
	crust		1
	tectonic		1
total			5

3462/3F Q9

question	answers	extra information	mark
(a)(i)	$A_1 = 0.5$	ignore any units	1
	$A_4 = 0.5$	allow **1** mark for $A_1 = A_4 \neq 0.5$	1
(ii)	the resistance of **P** is more than 20 Ω		1
	a smaller current goes through P / A_2 (than 20 Ω)	dependent on getting 1st mark correct accept converse	1
(b)(i)	potential difference = current × resistance	accept pd / voltage for potential difference accept V = I × R, correct symbols and correct case only accept volts = amps × ohms accept  provided subsequent method is correct allow combination of physical quantities and named units allow voltage = I × R	1
(ii)	6	allow **1** mark for correct substitution	2
(iii)	6	accept their (b)(ii)	1
(c)	<u>thermistor</u> or 	accept correct circuit symbol allow phonetic spelling	1
	<u>resistance</u> goes down (as temperature of thermistor goes up)	do **not** accept changes for goes down do **not** accept an answer in terms of current only answers in terms of other components are incorrect	1
total			10

4.1.3 National and global energy resources

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q10

question	answers	extra information	mark
(a)(i)	larger the distance, greater the time	accept 'they are proportional' accept converse	1
(ii)	any value between 6 and 9 years inclusive		1
(b)(i)	carbon dioxide		1
(ii)	(Venus) has high**er** temperature (than Mercury)	accept has the high**est** temperature accept Venus is hotter / hottest do **not** accept has a high / very high temperature	1
	(Venus) further from the Sun than Mercury	accept 'Venus is not the closest planet to the Sun' answer in terms of greenhouse effect only, scores **0** marks	1
total			5

4.1.3 National and global energy resources

3462/3F Q11

question	answers	extra information	mark
(a)(i)	20		1
(ii)	convection		1
(iii)	fit draughtproof strips	accept lay carpet accept fit curtains accept close doors / windows / curtains accept any reasonable suggestion for reducing a draught 'double glazing' alone is insufficient	1
(b)	air is (a good) insulator **or** air is a poor conductor	accept air cavity / 'it' for air	1
	reducing heat transfer by <u>conduction</u>	accept stops for reduces ignore convection do **not** accept radiation do **not** accept answers in terms of heat being trapped	1
(c)(i)	most cost effective	accept it is cheaper or lowest cost accept shortest payback time accept in terms of reducing heat loss by the largest amount do **not** accept it is easier ignore most heat is lost through the roof	1
(ii)	4		1
total			7

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q12

question	answers	extra information	mark
(a)(i)	constant speed	do **not** accept normal speed do **not** accept it is stopped / stationary	1
	in a straight line	accept any appropriate reference to a direction constant velocity gains **2** marks 'not accelerating' gains **2** marks terminal velocity alone gets **1** mark	1
(ii)	goes down owtte	accept motorbike (it) slows down	1
(b)(i)	20 (m/s)	ignore incorrect units	1
(ii)	acceleration = change in velocity / time (taken)	do **not** accept velocity for change in velocity accept change in speed accept $a = \frac{v-u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ **or** $a = \frac{\Delta v}{t}$ do **not** accept $a = \frac{v}{t}$	1
(iii)	4 **or** their (b)(i) ÷ 5	allow **1** mark for correct substitution	2
	m/s^2	m/s/s **or** ms^{-2} **or** metres per second squared **or** metres per second per second	1
(c)	vehicle may skid / slide	loss of control / brakes lock / wheels lock accept greater stopping distance **or** difficult to stop	1
	due to reduced friction (between tyre(s) and road)	accept due to less grip do **not** accept no friction	1

cont…

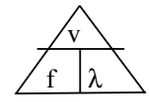
3462/3F Q12 cont…

(d)	any **three** from: • increased speed • reduced braking force • slower (driver) reactions • poor vehicle maintenance • increased mass / weight of vehicle • poor road surface • more streamlined	do **not** accept night time / poor vision NB specific answers may **each** gain credit eg tiredness (1), drinking alcohol (1), using drugs (1), driver distracted (1) etc specific examples may **each** gain credit eg worn brakes or worn tyres etc accept large mass / weight of vehicle if candidates give three answers that affect stopping distance but not specific to increase award **1** mark only	3
total			13

4.1.3 National and global energy resources

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q13

question	answers	extra information	mark
(a)	**Quality of written communication**	all emboldened terms in candidate's answer used correctly	1
	any **two** from: • **amplitude** decreasing • **wavelength** increasing • **frequency** decreasing	accept siren / sound getting quieter do **not** accept sound decreases accept pitch decreasing ignore reference to transverse wave ignore reference to speed contradictory statements within each point lose the mark	2
(b)(i)	ultrasound **or** ultrasonic		1
(ii)	wave speed = frequency × wavelength	accept speed / velocity for wave speed accept $v = f \times \lambda$ do **not** accept w for λ do **not** accept s for v accept  provided subsequent calculation shows a correct method	1
(iii)	339.2 **or** 340 **or** 339	allow **1** mark for using 212 000 allow **1** mark for correct substitution an answer of 0.3392 **or** 0.34 **or** 0.339 gains **1** mark only award full credit for a correct numerical answer with the unit changed to km/s	3
total			8

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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science: Double Award 3462/3F
Specification B

Mark Scheme

2006 examination - June series

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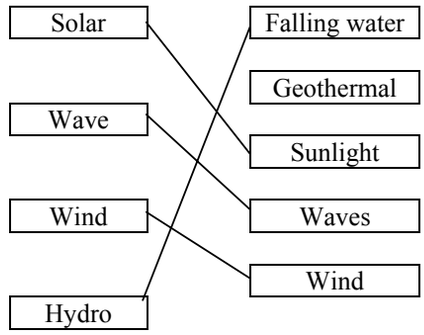
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Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

Double Award (Co-ordinated)
Foundation Tier 3462/3F

3462/3F Q1

question	answers	extra information	mark
(a)	4 correct lines drawn  	**1** mark for each correct line if more than 4 lines are drawn mark incorrect ones first. Mark only 4 lines	4
(b)	4		1
(c)(i)	nuclear		1
(ii)	(natural) gas	do **not** accept natural	1
total			7

4.1.3 National and global energy resources

3462/3F Q2

question	answers	extra information	mark
(a)(i)	ultra violet		1
(ii)	kill the cells	accept destroys the cells accept makes cells cancerous accept damage cells accept harms cells accept changes DNA accept cause cells to mutate accept skin cells for cells accept cause cancer do **not** accept skin for cells do **not** accept burns the cells	1
(b)(i)	the sunbed uses an alternating current (a.c.) supply		1
(ii)	10.8	accept **1** mark for correct substitution of power in W or kW and time in hours or seconds	2
total			5

4.1.3 National and global energy resources

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q3

question	answers	extra information	mark
(a)(i)	M		1
(ii)	K		1
(iii)	J		1
(iv)	O		1
(b)(i)	billions of years		1
(ii)	red giant	any answer in terms of explosion or supernova is **incorrect**	1
	contracts / shrinks to	incorrect reference to black hole negates **1** mark	1
	white dwarf		1
total			8

4.1.3 National and global energy resources

3462/3F Q4

question	answers	extra information	mark
(a)(i)	A and C	**both** answers must be correct in either order	1
(ii)	A and B	**both** answers must be correct in either order	1
(iii)	same number of protons plus neutrons **or** same number of nucleons	accept number of particles in nucleus the same do **not** accept they add up to 6 unless qualified	1
(b)(i)	any **two** from: • boron - 12 • carbon - 14 • oxygen - 15 • lead - 209	**both** required both name **and** number must be given	1
(ii)	any **two** from: • boron - 11 • carbon - 12 • oxygen - 16 • lead - 207	**both** required both name **and** number must be given	1
(c)	alpha		1
total			6

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q5

question	answers	extra information	mark
(a)	(good) insulator	accept does not conduct (electricity) accept does not conduct heat or electricity do **not** accept does not conduct heat outside is tough is insufficient	1
(b)	fuse		1
(c)	connect the green and yellow / earth wire	accept wires must be connected to screws	1
	swap the brown and blue wires round		1
total			4

3462/3F Q6

question	answers	extra information	mark
(a)	fossils	answers can be in either order	1
	water		1
(b)	increased		1
(c)	radio telescope		1
total			4

3462/3F Q7

question	answers	extra information	mark
(a)(i)	electrical		1
	kinetic	accept movement	1
(ii)	heat	answers can be in either order	1
	sound		1
(b)(i)	360	accept **1** mark for correct substitution	2
(ii)	watt		1
(c)	the stairlift is not moving the stairlift is moving at constant speed	**both** answers are required for the mark	1
total			8

3462/3F Q8

question	answers	extra information	mark
(a)(i)	(up) further **or** (up) faster	any reference to downwards movement loses credit accept <u>with</u> more force accept motion would increase	1
(ii)	down	accept the opposite way accept drop	1
(b)(i)	direct current		1
(ii)	Z		1
total			4

4.1.3 National and global energy resources

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q9

question	answers	extra information	mark
(a)	level of radiation (detected) will not change	ignore reference to particles	1
	if thickness of aluminium changes	accept for **both** marks a specific example eg if the aluminium gets thicker the level of radiation detected stays the same. accept for **1** mark gamma will pass through aluminium	1
	QoWC for 2 points in a sensible sequence		1
(b)	S W T V	all in correct order accept **2** marks for 2 correct accept **1** mark for 1 correct	3
total			6

4.1.3 National and global energy resources

3462/3F Q10

question	answers	extra information	mark
(a)	0.05 (A)	ignore incorrect units if given accept 'the same' / 'the same as K' / 'the same as the other ammeter' do **not** accept 'same as the other meter'	1
(b)(i)	any **two** from: • two cells are joined + to +	answers in terms of current gain no marks accept one cell in the wrong way accept two cells are joined back-to-back accept two cells are joined – to – accept battery for cell do **not** accept answers in terms of all the cells or in terms of energy only	2
	• some of the cells potential difference is across the diode / ammeters / wires **or** the pd of the cells is shared by all components	accept voltage for pd do **not** accept using up pd	
	• the other components have a resistance	accept a named component / components / wire has a resistance	
	• cells not fully charged **or** cells partially run down	do **not** accept voltage of cells is less than 1.5 unless explained do **not** accept cells are not as powerful unless explained	
	• cells have an internal resistance		
(ii)	the diode has a (very) high resistance (in the reverse direction)		1
	a diode only conducts / allows current to flow in one direction	accept little / no current flows do **not** accept blocks / cuts flow	1

Continued

4.1.3 National and global energy resources

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q10

question	answers	extra information	mark
(c)	**QoWC** for the use of the word resistance	annotate Q✓ Q✗ accept resistant	1
	accept increase / change / decrease throughout question but a contradiction loses **one** mark with change as neutral		
	as the pd / current increases / changes	accept voltage for pd must be correctly linked to at least one of the following points accept	1
	the temperature of the filament increases / changes	lamp / bulb for filament accept filament becomes hotter	1
	increasing / changing the **resistance** of the lamp	accept for **1** mark only the filament lamp does not obey Ohm's law	1
total			9

4.1.3 National and global energy resources

3462/3F Q11

question	answers	extra information	mark
(a)	0.5		1
	hertz	accept Hz but **not** HZ / hz / hZ accept (waves) per second **or** / sec **or** / s **or** s^{-1} **or** sec^{-1}	1
(b)	any **one** from: • any named part of the electromagnetic spectrum • S – waves / secondary waves • wave on a rope	 do **not** accept seismic waves / earthquake do **not** accept slinky unless clearly described	1
(c)	transverse – disturbance / vibration is perpendicular to the direction of energy transfer / wave travel	accept a correctly labelled diagram	1
	longitudinal – disturbance / vibration is parallel to the direction of energy transfer / wave travel	accept a correctly labelled diagram part explanation of the difference between transverse **and** longitudinal gains **1** mark	1
(d)(i)	TIR shown	needs to stay inside water jet ignore number of reflections **or** arrow heads lines straight by eye	1
(ii)	bigger than	any indication of correct answer	1
total			7

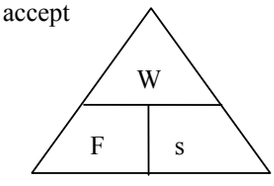
4.1.3 National and global energy resources

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q12

question	answers	extra information	mark
(a)	W		1
	has only two states **or** is either on or off	accept discrete values only do **not** credit answer purely in terms of shape	1
(b)	any **one** from:		1
	• higher quality	accept clearer do **not** accept easier to read ignore faster accept <u>less</u> distortion **or** <u>less</u> weakening of signal strength do **not** accept no distortion / weakening on its own	
	• increased carrying capacity	accept more information can be sent **or** more channels	
	• errors can be rectified		
total			3

3462/3F Q13

question	answers	extra information	mark
(a)(i)	all points plotted accurately	accept **1** mark for 5 correct plots ± ½ small square on stopping distance	2
	line of best fit must be continuous	accept attempt at a reasonable curve does not need to go through 0 0 do **not** accept a straight line do **not** accept dot-to-dot	1
(ii)	4 to 6 (metres)	accept ecf from (a)(i) accept **1** mark for value taken correctly from graph at 25mph **or** correct method shown	2
(b)(i)	0.7 (s)	incorrect unit = 0 marks	1
(ii)	constant speed / velocity	accept (continued as) 30mph accept did not change / stayed the same accept no acceleration	1
(iii)	3.3(s)	penalise incorrect unit once only	1
(iv)	reaction time increases / is longer **or** thinking distance increases	do **not** accept reaction time slower **or** reactions are slower	1
	stopping distance / it increases	do **not** accept travels at constant speed for longer	1
(c)(i)	work done = force (applied) × distance (moved)	accept W = F × s or W = F × d accept  provided subsequent method is correct	1
(ii)	2100	accept 2.1 kilo accept **1** mark for using 7000 N	2
(iii)	2100 (joules)	accept their (c)(ii)	1
total			14

4.1.3 National and global energy resources

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q14

question	answers	extra information	mark
(a)(i)	refraction		1
(ii)	it changes speed **or** change in density	accept it speeds up do **not** accept it slows down do **not** accept air is more dense than glass	1
(b)(i)	sound / waves <u>diffract</u> through the gap (in the wall) **or** over the wall **or** because the gate is open	do **not** accept reflection this only scores if first marking point is given accept for **1** mark only sound / waves go through the gap and <u>spread out</u> **or** diagram showing wave fronts spreading out from open gates if diagram is labelled as diffraction both marks can be scored	1 1
(ii)	less diffraction	accept no diffraction accept gates <u>absorb</u> sound / noise / waves accept gates <u>reflect</u> sound / noise / waves do **not** accept rebounds / stops / blocks out	1
total			5

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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1F Unit Physics 1

Mark Scheme

2007 examination - June series

4.1.3 National and global energy resources

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It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Dr Michael Cresswell, Director General.

4.1.3 National and global energy resources

MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

4.1.3 National and global energy resources

PHY1F Question 1

	answers	extra information	mark
(a)(i)	grid	accept any way of indicating correct answer	1
(ii)	increases voltage	accept any way of indicating correct answer	1
(iii)	230 V	accept any way of indicating correct answer	1
(iv)	reduce	accept any way of indicating correct answer	1
(b)(i)	increases the temperature	accept make it hotter / heat goes into the air accept convection currents accept sensible comment eg sound energy / it buzzes ignore pollutes the air	1
(ii)	less than 100%		1
total			6

PHY1F Question 2

	answers	extra information	mark
(a)	coal		1
(b)	fossil fuels can be used to generate electricity at any time a few large power stations can generate the electricity for a million homes	if more than 2 boxes ticked, mark incorrect boxes first	1 1
(c)(i)	no fuel is burnt	accept a named fuel accept nothing is burnt accept does not use (fossil) fuel	1
(ii)	kinetic		1
(iii)	any **two** from: • cause <u>noise</u> pollution • cause <u>visual</u> pollution • need concrete for bases • new roads / infrastructure needed • may interfere with TV / radio / mobile phone signals • dangerous to birds • do not generate all of the time • need a lot of generators • high <u>initial</u> / <u>capital</u> costs • reduces house prices	accept causes pollution for **1** mark accept generates <u>only</u> when the wind blows do **not** accept 'generate when the wind blows' do **not** accept 'take up a lot of space / land'	2
total			7

4.1.3 National and global energy resources

PHY1F Question 3

	answers	extra information	mark
(a)(i)	7pm	accept 19.00 / 1900	1
(ii)	8pm	accept 20.00 / 2000	1
	temperature drops more slowly	accept heat for temperature	1
		accept line is less steep	
(b)	insulator		1
	conduction*	*answers can be either way around	1
	convection*		1
(c)(i)	4 (years)		1
(ii)	it is the cheapest / cheaper / cheap	do **not** accept answers in terms of heat rising or DIY	1
	has the shortest / shorter payback time	do **not** accept short payback time	1
total			9

PHY1F Question 4

	answers	extra information	mark
(a)(i)	any **one** from: • gamma • X-rays • infra red • microwaves • radio	 accept correct symbol accept IR do **not** accept heat do **not** accept TV	1
(ii)	all the waves travel at the same speed		1
(b)(i)	(skin) cancer / melanoma	accept damage eyesight accept sunburn do **not** accept sun tan do **not** accept sunstroke	1
(ii)	higher levels of UV <u>greater</u> risk to health / risk of skin cancer / (more) protection needed / most likely to get burnt / damage skin	accept UV at its strongest / sun's rays are strongest ignore 'sun is at its hottest' ignore 'sun is at its highest' accept greater damage to / easier to damage cells / mutate cells ignore just 'affect your health' must be idea of greater adverse effect on health	1 1
total			5

4.1.3 National and global energy resources

PHY1F Question 5

	answers	extra information	mark
(a)	C		1
(b)(i)	easy to maintain / access **or** (currently) cheaper than a space telescope **or** can modify (easily) an existing telescope **or** telescopes can be larger **or** can test new types of telescope (easily)	do **not** accept 'easier to use' do **not** accept easier to supply with power	1
(ii)	atmosphere does not block / distort the image	accept picture / data for image accept 'more detailed / clearer image / data / picture accept 'no light pollution' accept 'can look at the Earth' do **not** accept 'can see further' do **not** accept 'better view' do **not** accept 'clear view' do **not** accept 'can see more clearly'	1
total			3

PHY1F Question 6

	answers	extra information	mark
(a)(i)	electromagnetic (wave / radiation)	accept em (wave / radiation) ignore reference to frequency	1
(ii)	gamma can penetrate the crate / box / packaging	accept converse (but must relate to both alpha and beta) ignore just gamma radiation kills bacteria accept can get through to food	1
(iii)	neutrons		1
(b)(i)	absorb gamma / radiation	accept it stops / reduces the radiation	1
(ii)	any **one** from: • slow down the conveyor belt • food does more than one circuit • stay on the conveyor belt longer • food closer to the source / radiation	ignore larger doses / use more of the source ignore thinner packaging	1

Continued on next page

Question 6 continued

	answers	extra information	mark
(c)(i)	idea of testing food on humans / animals		1
	no (measured) ill effects **or** monitor their health	accept monitor people that have eaten the food accept a measurement / comparison for **1** mark eg measure the amount of radiation in treated food comparison plus a reason for the comparison would get **2** marks eg idea of measuring level of radiation in treated food **with** no measurable increase in level = **2** marks **or** comparing it to untreated food = **2** marks	1
(ii)	so can make own decision about eating or not eating treated food	accept may be against their religious / moral views accept some people prefer food that hasn't been tampered with ignore in case they don't like the idea of eating treated food accept don't want to eat treated food ignore might be allergic to the food eg think it will give them cancer = **0** marks think it will give you cancer so I need to know so that I can choose = **1** mark	1
total			8

4.1.3 National and global energy resources

PHY1F Question 7

	answers	extra information	mark
(a)	the outside colour of the cans		1
(b)(i)	18 (°C) **or** 88 to 70	ignore negative sign	1
(ii)	8 (°C) **or** 70 to 62	ignore negative sign	1
(c)	greater temperature difference between water and surroundings (at start)	must mention temperature difference ignore just water hotter accept energy used to heat cans initially	1
(d)	black temperature falls the fastest (in L) black is a good / the best / better emitter (of heat / radiation)	 accept (can L) loses more heat / cools quicker accept heat for temperature accept converse ignore black is best absorber	1 1 1
total			7

4.1.3 National and global energy resources

AQA

GCSE

Science A / Physics

PH1FP

Mark scheme

4405/4403
June 2015

Version/Stage: 1.0 Final

4.1.3 National and global energy resources

PMT

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Mark Scheme

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2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of errors / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.1 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.2 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.3 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.4 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.5 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.6 Brackets

(.....) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.2 Ignore / Insufficient / Do not allow

Ignore of insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

4. Quality of Communication and levels marking

In Question **7a** students are required to produce extended written material in English, and will be assessed on the quality of their communication as well as the standard of the scientific response.

Students will be required to:
- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic
- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

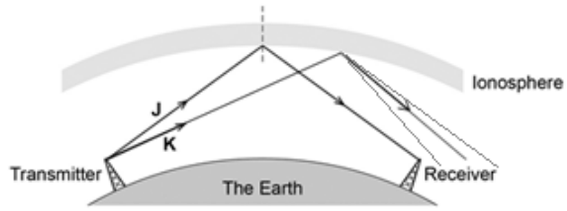
Level 2: clear
- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed
- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar

4.1.3 National and global energy resources

PMT

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1FP– JUNE 2015

Question	Answers	Extra information	Mark	AO / Spec. ref.
1(a)(i)	reflection of wave **K** at or within the ionosphere angle i = angle r  	allow dashed lines 'judge by eye' tolerance for the reflected ray is between the first e and last r ignore arrows a reflected ray to the receiver doesn't score 2nd mark additional rays shown doesn't score 2nd mark	1 1	AO2 P1.5.2b
1(a)(ii)	normal		1	AO1 P1.5.2a
1(b)(i)	microwave		1	AO1 P1.5.1k
1(b)(ii)	refraction		1	AO1 P1.5.1g
1(c)	All electromagnetic waves are transverse. All electromagnetic waves have the same speed in a vacuum.		1 1	AO1 P1.5.1b, c, d
Total			**7**	

4.1.3 National and global energy resources

Question	Answers	Extra information	Mark	AO / Spec. ref.
2(a)	chemical kinetic sound	correct order only	1 1 1	AO1 P1.2.1a
2(b)	48% or 0.48	an answer of 0.48 with a unit gains **1** mark an answer of 0.48% gains **1** mark an answer of 48 with or without a unit gains **1** mark	2	AO2 P1.2.1d
Total			**5**	

4.1.3 National and global energy resources

Question	Answers	Extra information	Mark	AO / Spec. ref.
3(a)(i)	because they contain free electrons		1	AO1 P1.1.3a
3(a)(ii)	because they are good absorbers of infrared radiation		1	AO1 P1.1.1c
3(b)(i)	insulators		1	AO1 P1.1.3a
3(b)(ii)	the rate of energy transfer would be lower.		1	AO1 P1.1.3c
3(c)	power time	allow the temperature (of the oven) watts or wattage is insufficient	1 1	AO1 P1.3.1b
3(d)	it can be switched on / off remotely	accept sensible suggestions about remote operation eg can be turned on / off from work **or** food can be cooked before you get home	1	AO3 P1.1
Total			**7**	

PMT

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1FP– JUNE 2015

Question	Answers	Extra information	Mark	AO / Spec. ref.
4(a)	20 790 (J)	an answer of 21 000 (J) (2 s.f.) gains **2** marks allow **1** mark for correct substitution: ie E = 0.33 x 4200 x 15 provided no subsequent step shown	2	AO2 P1.1.4d
4(b)	temperature		1	AO1 P1.1.4d
4(c)	(top pan) balance	accept scales do **not** accept a scale do **not** accept weighing scales do **not** accept newtonmeter do **not** accept spring balance	1	AO1 P1.1.4d
4(d)	dark / black / (dark) grey convection	 correct order only	1 1	AO1 P1.1.1c P1.1.3c
4(e)(i)	created	accept made	1	AO1 P1.2.1a
4(e)(ii)	increases		1	AO1 P1.2.1c
Total			**8**	

Question	Answers	Extra information	Mark	AO/Spec. ref.
5(a)(i)	high levels of infrared radiation (from the Sun)	allow lots of (solar) energy (available) do **not** accept 'heat' for infrared 'it is hot' is insufficient 'lots of sunlight' is insufficient	1	AO2 P1.4.1a
5(a)(ii)	reflected		1	AO1 P1.5.1g
5(a)(iii)	boiler turbine transformer	correct order only	1 1 1	AO1 P1.4.1a
5(b)	2 100 000 (kWh)	allow **1** mark for correct substitution i.e. 140 000 x 15 provided no subsequent step	2	AO2 P1.3.1c
5(c)(i)	only 1 wind turbine was considered **or** other wind turbines may have generated more electricity only 1 week's weather was reported on **or** wind speed varies from one week to another	accept only one location is considered accept insufficient sample size 'wind speed varies' is insufficient	1 1	AO3 P1.4
5(c)(ii)	any **one** from: • wind speed is too high / low • wind is unreliable	allow no wind allow too windy allow wind is variable	1	AO1 P1.4

Question 5 continues on the next page . . .

Question 5 continued . . .

Question	Answers	Extra information	Mark	AO/Spec. ref.
5(c)(iii)	any **one** from: • wind is a renewable energy source • do not use fuel • energy source is free • do not release carbon dioxide • do not release greenhouse gases • do not release sulfur dioxide • do not cause acid rain • do not cause climate change • do not cause global warming • do not cause global dimming	answer must be an advantage of wind, converse answers in terms of fossil fuels are insufficient accept do not release pollutant gases 'no pollution' is insufficient	1	AO1 P1.4.1f
Total			**11**	

Question	Answers	Extra information	Mark	AO / Spec. ref.
6(a)(i)	C		1	AO2 P1.5.4a
6(a)(ii)	The speed of star **B** is less than the speed of star **D**.		1	AO3 P1.5.4b
6(b)	300 000 000 m/s	allow **1** mark for correct substitution ie 200 000 x 1500 provided no subsequent step shown allow unit correctly indicated in list if not written in answer space	2 1	AO2 AO1 P1.5.1j
Total			**5**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7 (a)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 4 and apply a 'best-fit' approach to the marking.		6	AO2 AO3 P1.2 HSW

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant information	There is a relevant statement about an energy saving method	There is at least one clear comparison of energy saving methods and their cost effectiveness with an appropriate calculation	There is a comparison of energy saving methods and their cost effectiveness with appropriate calculations. Comparison to include further detail.

examples of physics points made in the response	extra information
examples of relevant statements • energy efficient boiler saves the most (energy / money) per year • loft insulation costs the least to install • double-glazing costs the most to install **examples of statements that include cost effectiveness** • loft insulation is the most cost effective in the long term • double-glazing is the least cost effective • loft insulation has the shortest payback time • double-glazing has the longest payback time • payback time calculated for any method **examples of further detail** • for cost effectiveness install in the following order: loft, cavity wall, boiler, double-glazing • for reducing energy use install in the following order: boiler, loft, cavity wall, double glazing • don't install double-glazing for insulation purposes • double-glazing won't pay for itself in your lifetime • justified choice of best / worst method	payback times: energy efficient boiler: 6.25 years loft insulation: 2 years double glazing: 100 years cavity wall insulation: 2.86 years

Question 7 continued . . .

Question	Answers	Extra information	Mark	AO / Spec. ref.
7(b)(i)	how effective a material is as an insulator	accept 'heat' for energy accept how effective a material is at keeping energy in accept the lower the U-value the better the insulator accept the lower the U-value the lower the rate of energy transfer	1	AO1 P1.1.4a
7(b)(ii)	(the U-value) decreases		1	AO1 P1.1.4b
Total			**8**	

PMT

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1FP– JUNE 2015

Question	Answers	Extra information	Mark	AO / Spec. ref.
8(a)(i)	0.5 °C		1	AO3 P1.1
8(a)(ii)	data is continuous **or** both variables are continuous **or** independent variable is continuous **or** time is continuous	accept results / measurements for data accept data is not categoric one variable is continuous is insufficient air temperature is continuous is insufficient	1	AO3 P1.1
8(b)(i)	20.5 (°C)		1	AO2 P1.1
8(b)(ii)	60 (minutes)	accept 1 hour	1	AO2 P1.1
8(c)(i)	so a comparison can be made **or** outside temperature is a control variable	accept: (outside) temperature would affect energy required (to maintain temperature of the house) **or** (outside) temperature would affect internal temperature (of the house) **or** heat loss will be faster on a cold day outside temperature will affect the results is insufficient fair test is insufficient	1	AO3 P1.1

Question 8 continues on the next page . . .

Question	Answers	Extra information	Mark	AO / Spec. ref.
8(c)(ii)	the cost is equal to the number of kWh x the cost per kWh calculation 0.8 / 8.0 = 0.1 or 10%	accept (heating) bill depends on (number of) kWh used accept energy for kWh allow 7.2 / 8.0 = 0.9 or 90%	1 1	AO3 AO2 P1.1
8(c)(iii)	heating is on for more / less time (than anticipated) because some days it is cooler / warmer (than anticipated)	 accept other sensible suggestions an answer giving two sensible situations gains **2** marks possible examples: • some houses have different amounts of insulation • there are different styles of house temperature (inside / outside) is always changing is insufficient	1 1	AO3 P1.1
Total			**9**	

AQA

GCSE

Science A / Physics

PH1FP

Mark scheme

4405/4403
June 2016

Version 1.0: Final Mark Scheme

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In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of errors / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Accept / allow

Accept is used to indicate an equivalent answer to that given on the left-hand side of the mark scheme. Allow is used to denote lower-level responses that just gain credit.

3.9 Ignore / Insufficient / Do not allow

Ignore of insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

4. Quality of Communication and levels marking

In Question **7(b)** students are required to produce extended written material in English, and will be assessed on the quality of their communication as well as the standard of the scientific response.

Students will be required to:
- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic
- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear
- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed
- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)	geothermal nuclear biofuel		1 1 1	AO1 1.4.1a 1.4.1d
1(b)	gravitational (potential) kinetic sound		1 1 1	AO1 1.3.1a 1.4.1b
1(c)(i)	90% or 0.9(0)	an answer of 0.9(0) with a unit gains **1** mark an answer of 90 with no unit or an incorrect unit gains **1** mark	2	AO2 1.2.1d
1(c)(ii)	60 (MW)	allow 10%	1	AO2 1.2.1b
1(c)(iii)	increased		1	AO1 1.2.1c
Total			**10**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	46 200	accept 46 000 allow **1** mark for correct substitution ie 0.5 x 4200 x 22 provided no subsequent step	2	AO2 1.1.4d
2(b)	Energy is used to heat the kettle.		1	AO2 1.2.1b
2(c)	9 (pence)	allow **1** mark for correct substitution ie 0.6 x 15 provided no subsequent step	2	AO2 1.3.1d
2(d)(i)	conduction and convection		1	AO1 1.1.3a
2(d)(ii)	any **one** from: • water stays hotter for longer (than a 'conventional' kettle) • water boiled less often • less energy transferred to the surroundings • (new design is) more efficient		1	AO2 1.2
Total			**7**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)(i)	any **one** from: • (visible) light • UV / ultra violet • X-ray • gamma / γ-ray		1	AO1 1.5.1e
3(a)(ii)	less than less than the same as		1 1 1	AO1 1.5.1d 1.5.1e
3(b)(i)	(the) Big Bang (theory)		1	AO1 1.5.4e
3(b)(ii)	the red-shift of light from distant galaxies		1	AO1 1.5.4c
Total			**6**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	dependent		1	AO3 1.1.3b
4(b)	The equipment has a better resolution.		1	AO3 1.1.3
4(c)	(probe) C largest difference between reading and actual temperature	allow 103.2 reason only scores if C chosen accept larger it is 3.2 greater is insufficient comparing C with only one other probe is insufficient	1 1	AO3 1.1.3
4(d)(i)	12(°C)	accept a value between 12.0 and 12.2 inclusive	1	AO2 1.1.3d
4(d)(ii)	140 (seconds) <u>temperature</u> starts to rise	accept an answer between 130 and 150 inclusive only scores if time mark awarded accept the <u>temperature</u> was lowest (at this time)	1 1	AO2 AO3 1.1.3b
4(d)(iii)	increase	accept faster (rate)	1	AO1 1.1.3b
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	it would decrease the time		1	AO3 1.2.1a
5(b)	720 (J)	allow **1** mark for correct substitution ie 12 x 60 provided no subsequent step	2	AO2 1.3.1c
5(c)	dense rises falls	 accept equivalent words accept equivalent words	1 1 1	AO1 1.1.3a
5(d)	 decreases decreases decreases	more than one tick in any row negates the mark	 1 1 1	AO3 1.1.3c 1.1.3d
Total			**9**	

4.1.3 National and global energy resources

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1FP– JUNE 2016

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)	frequency		1	AO1 1.5.3b
6(b)	echo(es)		1	AO1 1.5.3c
6(c)	spreading (out) equal to	changing direction is insufficient moving apart is insufficient bending is insufficient accept: similar to same (order of magnitude) as slightly smaller than slightly larger than	1 1	AO1 1.5.1g
6(d)	340 (m/s)	allow **1** mark for correct substitution ie 25 000 x 0.0136 provided no subsequent step or allow 1 mark for a correct calculation showing an incorrect value from conversion to hertz x 0.0136 an answer of 0.34 gains **1** mark	2	AO2 1.5.1j
6(e)	(a wave where the) oscillations are parallel to the direction of energy transfer causing (areas of) compression and rarefaction	both marking points may appear as labels on a diagram accept vibrations for oscillations accept in same direction as for parallel to allow direction of wave (motion) for direction of energy transfer accept correct description in terms of particles mechanical wave is insufficient needs a medium to travel through is insufficient	1 1	AO1 1.5.1b
Total			**8**	

4.1.3 National and global energy resources

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)	any **one** from: • high cost of installing overhead power lines or underground cables or pylons • high cost as (very) long cables needed • amount of electricity required is too low	allow not enough (surplus) electricity would be generated	1	AO1 1.4.1e

Question 7 continues on the next page . . .

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7 (b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.		6	3 AO1 2 AO2 1 AO3 1.4.1b

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant information	at least **one** advantage **or one** disadvantage of either method	at least **one** advantage **and one** disadvantage is stated for **one** method **and** a different advantage **or** disadvantage is stated for the other method	clear comparison of advantages **and** disadvantages of **each** method

examples of physics points made in the response	extra information
Advantages of both methods: • both renewable sources of energy • both have no fuel (cost) • both have very small (allow 'no') running costs • no carbon dioxide produced	 accept carbon neutral accept no greenhouse gases accept doesn't contribute to global warming
Advantages of wind: • higher average power output	 produces more energy is insufficient
Advantages of hydroelectric: • constant / reliable power (output) • lower (installation) cost	
Disadvantages of wind: • higher (installation) cost • variable / unreliable power output • (may) kill birds / bats	
Disadvantages of hydroelectric: • lower power output • (may) kill fish or (may) damage habitats • more difficult to set up (within river)	
Disadvantages of both methods • (may be) noisy • visual pollution	 ignore payback time unless no other relevant points made ignore time to build for both

Total			7

4.1.3 National and global energy resources

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1FP– JUNE 2016

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(a)	a proportion / percentage of the energy is wasted	allow heat for energy allow some energy is wasted	1	AO2 1.2.1b 1.2.1c
	(wasted) energy is transferred to surroundings **or** energy is needed to heat pan (before food is heated)		1	
8(b)	(fins have a) large(r) surface area	accept fins increase the surface area	1	AO1 1.1.1c 1.1.1e 1.1.3c
	(black metal surface is a) good / better absorber of infrared radiation	allow 'heat' or 'energy' for infrared radiation ignore good emitter of infrared radiation not a good reflector is insufficient	1	
8(c)	the higher the temperature (of the saucepan) the greater the rate at which infrared radiation is emitted	accept converse answer allow the higher the temperature the more infrared radiation is emitted allow there is a positive correlation	1	AO2 1.1.1b
Total			**5**	

4.1.3 National and global energy resources

Answer 99 · Examiner comments June 2022 | 8463/1F | Original Q7

Question 7 (Low and standard demand)

07.1 Approximately 50% of students scored both marks. Many students stated nuclear was renewable. Many students stated biofuel was non-renewable.
Students who guessed often scored zero as 2 correct ticks were not enough to score a mark.

07.2 Less than 3% of students scored full marks. Students who scored 1 mark usually scored the 3rd marking point for 'energy'. The 4th marking point scored more often than the 1st or 2nd marking points.

07.3 95% of students answered correctly as they had all the Physics equations on the Equations Sheet for the 2022 series.

07.4 Few students attempted to convert the time into seconds, so arrived at an answer of 650 000, scoring 2 marks. Few students chose the correct unit, watts being a common incorrect response. 15% of students scored all 4 marks.

Answer 100 · Examiner comments June 2022 | 8463/1F | Original Q9

Question 9 (Standard demand)

09.1 Approximately 10% of students scored 2 marks. The unit conversion caused a problem for many students and powers of 10 errors were frequently seen. A correct calculation using an incorrectly or not converted value for power would score 1 mark.

09.2 Students were quite successful answering this questions with 25% scoring 2 marks and about 55% scoring 1 mark. Most students wrote variations of the first and third bullet points in the markscheme. A number of students wrote that the turbines may be broken, which was enough to score a mark for the idea of maintenance.

09.3 'Turbine will rotate faster' was insufficient to score a mark. 'Rotate more smoothly' was not enough to score the 'less friction' mark. Students who stated that 'no energy was wasted' did not score the second marking point. 2% of students scored 3 marks, 10% of students scored 2 marks and about 30% of students scored 1 mark.

09.4 5% of students scored 2 marks, while about 35% of students scored 1 mark. Many students answered in terms of 'saving energy' which was insufficient. Other students answered in terms of absolute statements which did not score, 'energy efficient appliances waste no energy' for example.

4.1.3 National and global energy resources

Answer 101 · Examiner comments June 2023 | 8463/1F | Original Q3

Question 3 (Low and Standard Demand)

03.1 29% of students scored 2 marks, while 27 % of students scored 1 mark for this question about isotopes..

03.2 51% of students knew what half-life means.

03.3 77 % of students correctly identified the least stable isoptope.

03.4 Students found this question difficult with only 38% scoring 2 marks and 21% scoring 1 mark for this question about irradiation and contamination.

03.5 68% of students identified the purpose of the sticky floor.

03.6 72% of students scored 2 marks on this calculation question.

03.7 This question discriminated well with 46 % of students scoring 2 marks and 20 % of students scoring 1 mark for this question about fission and fusion

Answer 102 · Examiner comments June 2023 | 8463/1F | Original Q4

Question 4 (Low and Standard Demand)

04.1 93% of students scored 2 marks on this calculation question.

04.2 84% of students scored 2 marks for this calculation question.

04.3 In this exam series students were provided with an equations sheet with all equations given. 95 % of students answered the question correctly.

04.4 A question that discriminated well. 16% of students scored 3 marks, while 63 % of students scored 2 marks for an answer of 180 000, having not converted the time to seconds.

4.1.3 National and global energy resources

Answer 102 · Examiner comments June 2023 | 8463/1F | Original Q4

04.5 Some students appeared to confuse the power output of the hydroelectric generator with the power demand of the consumers. 'People use less power in the summer' being seen as a common incorrect answer. Students needed to link rainfall / water level to the summer months to score both marks. Referring to 'hotter months' was insufficient for 'summer months' or named months. Examples of specific changes were creditworthy eg 'less/more water in the river' or 'rainfall may be less/more' for the 1st marking point. Both marking points could be the converse of what appeared in the mark scheme. 30% of students scored 2 marks, while 22% of students scored 1 mark.

Answer 103 · Examiner comments June 2024 | 8463/1F | Original Q9

Question 9 (Standard demand)

09.1 74% of students scored this mark. Common incorrect answers were 'method A' or 'method B', students thinking they were linking a method to the energy transfer.

09.2 63% of students scored this mark. Common incorrect answers were 'method A' or 'method B' students thinking they were linking a method to the energy transfer. Another common answer was 'hydroelectric energy' which didn't score. The word 'potential' was needed for an answer of 'gravitational potential'. As the question was worded it seemed reasonable to credit 'kinetic' since the water moving uphill would have kinetic energy before it reached its destination and stored only gravitational potential energy.

09.3 Many students failed to realise that the calculations needed were to show the amount of stored energy wasted or the amount of stored energy usefully transferred. Simple subtractions were insufficient to score the calculation marks. To score 4 marks, two comparisons were needed in addition to a comparative calculation. Although the comparative calculation performed by a minority of students involved dividing 33 600 kJ by 490 kJ and getting an answer of 68.6, which is the number of times more energy stored by method A compared to B. This single calculation was enough to score 4 marks with the two simple comparisons. The installation comparison only scored if value was added to the information eg Method A is easier to install or is likely to cost less money. 21% of students scored 3 or 4 marks, while 65% of students scored 1 or 2 marks.

09.4 A straightforward question that students found easy to answer with 40% of students scoring 3 or 4 marks, while 40% of students scored 1 or 2 marks. A lot of students gave an alternative solution without saying what activity should be reduced or stopped. An example would be 'use electric cars' without saying 'instead of using petrol/diesel cars'. As the majority of cars on the road are still petrol/diesel if a student said 'don't use cars' it was taken to be a petrol/diesel car and scored a mark. Some students discussed the reduction of 'food miles' by forcing people to shop locally, which was also creditworthy. 10% of students didn't attempt answer this question part.

4.1.3 National and global energy resources

Answer 104 · Examiner comments June 2024 | 8463/1F | Original Q10

Question 10 (Standard demand)

10.1 15 % of students scored 3 marks, 39% scored 2 marks and 30% scored 1 mark. The most common mark to score was either ‘nuclei’ or ‘gamma rays’.

10.2 In this exam series all equations were provided for the students on the Physics Equations Sheet. 94% of students scored the mark.

10.3 67% of students scored 2 marks for multiplying the power by the time, whether they had converted the power or not. Most attempts to convert the power were incorrect. Only 3% of students scored all 3 marks for this calculation of energy.

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Answer 104 · Examiner comments June 2024 | 8463/1F | Original Q10

10.4 13% of students scored a mark. ‘Wear protective clothing’ or ‘hazmat suits’ were common incorrect answers. Any idea of burying the radioactive waste was credited, so ‘bury it in a field’ was ok, as was ‘bury it in landfill’, which from a student’s perspective is equivalent to burying it underground. ‘Keeping it away from people’ was insufficient.

10.5 74% of students scored 2 marks, while 3% scored 1 mark. The answer of 29.2 days was worth 1 mark as this could only have been calculated by doing the correct calculation and then subtracting the result from 365.

Answer 105 · Examiner comments June 2025 | 8463/1F | Original Q1

01.1

Just over 80 % of the students chose global warming as the environmental problem.

01.2

Just over half of the students read the correct value of ‘6000 kg’ from the graph. The most common incorrect answer was 38 000 kg.

01.3

Almost 90 % of the students correctly identified that the amount of carbon dioxide increased as distance travelled increased.

4.1.3 National and global energy resources

Answer 105 · Examiner comments June 2025 | 8463/1F | Original Q1

01.4

Most of the students understood that electric cars are powered by a battery.

01.5

This question discriminated well between students matching method to generate electricity with an environmental issue. Students were more likely to score the radioactive waste mark than the other two. Overall 62 % of the students scored 3 marks, with 9 % of the students scoring 2 marks and 23 % of the students scoring 1 mark.

Answer 106 · Examiner comments June 2025 | 8463/1F | Original Q8

08.1

The idea that energy resources can or cannot be used again still persists and does not score any marks. The idea of 'running out' and 'not running out' was insufficient to score. Very few students used the word stated in the specification which is 'replenished'. 'Replaced' was allowed and 'produced' was the least creditworthy answer for the renewable energy definition. About 4 % of the students scored 2 marks and a further 30 % scored 1 mark.

08.2

Almost all of the students scored this mark for writing down the equation which links density, mass and volume.

Answer 106 · Examiner comments June 2025 | 8463/1F | Original Q8

08.3

Almost 70 % of the students scored 3 marks. Students who did not get the correct final answer could have scored 1 mark if they had substituted into the equation first before rearranging their equation, which was usually the reason their final answer was incorrect.

08.4

Almost none of the students scored 2 marks, while about 9 % of the students scored 1 mark. Students who wrote that tidal power output was greater than wind power did not score a mark without reference to a particular flow speed. If wind flow speed was a consistent 2 m/s and tidal flow speed never reached 0.75 m/s the wind turbine's power output would be greater.

08.5

Some students didn't understand the term 'environmental impact' and focussed their answers on reliability, efficiency and cost, scoring no marks. To score within level 2, students needed to make at least one comparative statement about a factor for both turbines. The simplest way of doing this was to compare relative size.
An answer;
'The wind turbine is larger, but harms birds. The tidal turbine harms fish but does not cause visual pollution' would have scored 4 marks.
Just fewer than 20 % of the students scored 3 or 4 marks, while almost 60 % of the students scored 1 or 2 marks.

4.1.3 National and global energy resources

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4.1.3 National and global energy resources

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General

Grade 1-3 calculation questions were well answered, where the equation is always given and students will not be required to rearrange the equation. Grade 4-5 calculation questions involving equation recall were answered better this year than in 2018 and students are scoring many of their marks on the paper by answering the subsequent calculation questions correctly. At grade 4-5 students are expected to be able to either rearrange an equation or convert a unit, so it is beneficial for students to be able to quickly identify if the units given in a question are correct for the use in the equation. Question 10.1 was generally well attempted and students who had carried out Required Practical Activity 2 would have had a material advantage over those who hadn't.

Handwriting sometimes makes it very difficult for examiners to read what has been written. Students who have handwriting that is difficult to read may benefit from a scribe or from word processing their answers in exams.

Levels of demand

Questions are set at two levels of demand on this paper:

- low demand questions are targeted at students working at grades 1–3
- standard demand questions are targeted at students working at grades 4–5.

A student's final grade, however, is based on their attainment across the qualification as a whole, not just on questions that may have been targeted at the level at which they are working.

Question 1 (Low demand)

01.1 Around 77% of students scored 2 marks. Around 16% of students scored 1 mark.

01.2 Only around 8% of students scored 2 marks. Both evaporation and change of state were common, insufficient answers for the first marking point. Less than half of the students scored 1 mark. The marking points were independent, so if the change of state was incorrect eg melting, the student could still score the second marking point.

01.3 Around 91% of students scored 2 marks. In calculations where students are provided with the equation (grades 1-3) students are not expected to rearrange the equation. Some students incorrectly tried to convert the kg into g and scored 0 marks.

01.4 Approximately 82% of students scored 3 marks. In calculations where students are provided with the equation (grades 1-3) students are not expected to rearrange the equation. Some students incorrectly tried to convert the kg into g and scored 0 marks for the calculation. Some students set out their calculation, but then multiplied the two values rather than dividing.

Question 2 (Low demand)

02.1 About 67% of students identified the correct decay equation.

02.2 More than three quarters of the students identified why alpha radiation is dangerous inside the human body.

02.3 Just below three quarters of students scored 2 marks. Most correct answers read the values from the graph as intended (460, 280) and students didn't need the tolerance given in the mark scheme.

02.4 About 60% of students correctly estimated the mass remaining.

02.5 Students found this question difficult, with around 55% of students scoring 2 marks and around 27% of students scoring 1 mark.

Question 3 (Low demand)

03.1 Approximately 45% of students scored 1 mark for identifying a measuring instrument that could be used. About 9% of students scored 2 marks for describing an appropriate way to use it. Pythagoras was insufficient as the triangle described would not give the height of the zip wire.

03.2 Students were often very successful in calculation, with around 91% scoring 2 marks.

03.3 This question gave a good spread of marks. Over a fifth scored 3 marks, almost two fifths scored 2 marks and slightly below a quarter scored 1 mark. Gravitational potential energy or gravitational field strength were insufficient to score a mark.

Question 4 (Low demand)

04.1 Over a third of students answered this question correctly.

04.2 About 14% of students answered this question correctly.

04.3 This question about the alpha particle scattering experiment discriminated well between students. Around 16% of students scored 3 marks, around 45% of students scored 2 marks and around 30% of students scored 1 mark.

04.4 About 77% of students correctly identified what reproducible means. .

Question 5 (Low demand)

05.1 The most common correct answers linked CO_2 to global warming. Around 38% of students scored 2 marks and around 35% scored 1 mark. Common incorrect answers were usually vague and mentioned air pollution without being specific. There were many students who incorrectly linked CO_2 with the ozone layer.

05.2 Over half of the students scored 2 marks and over a third scored 1 mark. Insufficient answers included hydro and water. Answers using specification wording eg the tides were acceptable, as were terms like tidal, etc. Oil was insufficient as this was assumed to be non-renewable oil as opposed to palm oil or other biofuel oils.

05.3 Around 83% of students scored 2 marks for this percentage calculation. An answer of 78 scored 1 mark even if spurious calculations followed.

05.4 About 67% of students scored 2 marks. Quite a large number of misreads from the graph resulting in 0 marks and around 29% of students scored 0 marks.

05.5 Only around 5% of students scored 2 marks whilst half of the students scored 1 mark. Some students failed to make the connection between the time of day and sunrise. Some students talked vaguely about the energy stored by solar panels, confusing them with solar heating panels rather than solar photovoltaic panels.

Question 6 (Low and Standard demand)

06.1 More than half of the students scored 2 marks. To score a mark a comparative statement was needed eg lower, not low mass of power source. A statement using the word 'better' would be insufficient.

06.2 Around 64% of students scored 2 marks. Many students scored 1 mark for truncating and not rounding their answers, an answer of 26.08 would score only 1 mark for the substitution.

06.3 This question discriminated well, with about 16% scoring 2 marks and more than half scoring 1 mark. 'Increases the battery's power output' was insufficient to score a mark. 'Battery lasts longer' was insufficient to score a mark.

06.4 The quantities in the question are given in alphabetical order; there is no need for students to recall the equation in this order. Any correct rearrangement of the equation or use of the correct symbols for quantities was allowed. A mixture of symbols and words would also score the mark. Approximately 70% of students answered this question correctly.

06.5 It was encouraging to see many Foundation tier students successfully rearranging the equation. Around 77% of students scored 3 marks.

Question 7 (Low and Standard demand)

07.1 About 86% of students answered this question correctly.

07.2 Approximately 83% of students answered this question correctly. Students should refer to the Physics specification for the accepted symbols for circuit components. Textbooks and revision guides do not necessarily use the specification symbols. The circles in the component symbol scored a mark even if shown as blobs rather than circles.

07.3 Around 93% of students scored 2 marks. At grade 1-3, the equation is given and no rearrangement of the equation is needed. Students need to simply substitute and calculate the answer.

07.4 Around 93% of students scored 2 marks. At grade 1-3, the equation is given and no rearrangement of the equation is needed. Students need to simply substitute and calculate the answer.

07.5 About 23% of students answered this question correctly.

07.6 About 38% of students answered this question correctly.

07.7 Students can recall the equation in any correct rearrangement. The stem of the question lists the quantities in alphabetical order, so that there is no suggestion of the correct order.

Correct letters for quantities are acceptable in place of the quantity names. Voltage or p.d. were acceptable for potential difference. Approximately 57% of students answered this question correctly.

07.8 The first mark is for the substitution into the correct equation. The second mark is for the correct rearrangement of the correct equation. The third mark is for the correct final answer. About 58% of students scored 3 marks for this question. Grade 4-5 calculation questions require either a unit change or a rearrangement of the equation.

Question 8 (Low and Standard demand)

08.1 Around 63% of students answered this question correctly.

08.2 Around 86% of students answered this question correctly. Some students gave a precaution instead of a risk, which was insufficient.

08.3 Around 62% of students answered this question correctly, demonstrating that students still confuse the terms resolution and range.

08.4 Around 96% of students answered this question correctly.

08.5 Many students failed to substitute correctly into the equation that was printed on the Physics Equations Sheet. Many students multiplied the 3 values given in the question, which scored zero marks. The unit mark was independent, but a large number of students failed to recognise the correct unit from the box. More than a third of students scored 4 marks and around 16% of students scored 3 marks. A quarter of students scored 1 mark for either the correct unit or the correct substitution.

Question 9 (Standard demand)

09.1 About 45% of students correctly identified the meaning of power input.

09.2 Only a quarter of students scored this mark. Students can recall the equation in any correct rearrangement. The stem of the question lists the quantities in alphabetical order, so that there is no suggestion of the correct order. Correct letters for quantities are acceptable in place of the quantity names. Voltage or p.d. were acceptable for potential difference.

09.3 Around 13% of students scored 3 marks and about 81% scored zero. Students found this question difficult to answer, presumably due to their inability to recall the correct equation in the preceding question.

09.4 More than half of students answered this correctly. Some students failed to score the mark by writing input for both the denominator and the numerator.

09.5 Students who successfully recalled the equation in **09.4** were likely to score all 3 marks for this question. Only around 15% of students scored zero.

09.6 Many students restated the stem, rather than going the extra stage in the reasoning and linking to efficiency because thermal energy is also transferred by the light bulb. A number of students believed that knowing the rate at which the bulbs emitted visible light was a

safety concern related to the household electrics. Only around 1% of students scored 2 marks, about 16% of students scored 1 mark and around 73% of students scored zero marks.

Question 10 (Standard demand)

10.1 This question produced a good spread of marks. A mean score of 2.1 was achieved by students on the Foundation tier. Students who had experience of a similar practical benefitted from this as they were able to describe a method in sufficient detail to achieve Level 2. To achieve Level 3, a student needed to indicate that several values of number of layers were used, referring to the interval of 8 layers (as the graph showed) or that the experiment should be done with no layers. A control variable was also needed, either the initial temperature of the water, or the volume of water in each experiment. Some students gained no credit by describing different required practical methods. Around 2% of students scored 6 marks, around 15% of students scored 4 marks and about a fifth of students scored 2 marks. Around 10% of students didn't attempt the question.

10.2 Many students stated that it wasn't necessary to use both as it would be confusing. The datalogger would produce too much data was a common insufficient answer. A number of students stated that using a normal thermometer would be more appropriate, scoring zero marks. Less than 1% of students scored 2 marks and less than a fifth of students scored 1 mark.

Question 11 (Standard demand)

11.1 Over two-fifths of students scored 3 marks for this question. It wasn't necessary to give the answer to an appropriate number of significant figures, so answers of 0.502, 0.50 and 0.5 were all creditworthy. Some students calculated the jump height to be unlikely values; students should be encouraged to consider whether it is likely that someone can jump a height of 4.92 m, a commonly seen answer achieved by multiplying the 2 values given (41 × 0.12). Less than half of the students scored zero marks.

11.2 A common incorrect answer was E_k = mass × speed, since these were the quantities given in the question. A number of students also left out the 0.5 value even if they remembered that speed should be squared. Velocity was allowed instead of speed in the equation. Correct symbols were acceptable for the quantities in the equation. About 30% of students answered this question correctly.

11.3 Despite being asked to recall the equation in 11.2, most students simply multiplied or divided the 2 values given in the question (3.0 and 270), scoring 0 marks. Only around 19% of students scored 3 marks.

11.4 Some students commented on muscle mass and strength which were insufficient to score marks. Clear comparisons, including at least one difference and one similarity, were needed to score 4 marks. This question discriminated well between students; around 6% of students scored 4 marks, around 29% of students scored 2 marks and around 13% of students scored zero.

4.1.3 National and global energy resources

11.5 Some students failed to score a mark because they simply restated the question, 'the scientist wanted the highest muscle power reading' without adding any value. The answer either needed to refer to the effect of repetition on performance (improvement or worsening) or that it was the maximum (or peak) muscle power that the scientist was investigating. A fifth of students answered this question correctly.

4.1.3 National and global energy resources

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.