AQA GCSE Physics | 8463

SPECIFICATION POINT 4.1.2.1

Energy transfers in a system

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**56**
Available paper years	**2005–2025**

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.

4.1.2.1 Energy transfers in a system

Answer 01 · Mark scheme June 2005 | 3451 | Original Q13 | Legacy

The full source mark scheme begins on page 52. Follow original question 13 in that document.

Answer 02 · Mark scheme June 2005 | 3462 | Original Q11 | Legacy

The full source mark scheme begins on page 70. Follow original question 11 in that document.

Answer 03 · Mark scheme November 2006 | PHY1A | Original Q5 | Legacy

Five	**A**	conduction	**1**
	B	convection	**4**
	C	insulation	**2**
	D	radiation	**3**

Answer 04 · Mark scheme November 2006 | PHY1A | Original Q8 | Legacy

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

Answer 05 · Mark scheme November 2006 | PHY1A | Original Q9 | Legacy

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

*** Q9D** The awarding committee agreed that there are two possible correct answers for this question and therefore the test was marked out of 35.

4.1.2.1 Energy transfers in a system

Answer 05 · Mark scheme

PHY1A (Energy and Electricity) Higher Tier

Question	Key		
One	**A**	conclusion	**2**
	B	evidence	**4**
	C	reliable	**1**
	D	research	**3**
Two	**A**	coal	**4**
	B	hydroelectric	**3**
	C	nuclear	**1**
	D	wind	**2**

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

*** Q4D** The awarding committee agreed that there are two possible correct answers for this question and therefore the test was marked out of 35.

4.1.2.1 Energy transfers in a system

Answer 06 · Mark scheme

Question 6

question	answers	extra information	mark
(a)(i)	as a source of thermal <u>radiation</u>	accept heat for thermal radiation accept to act as the Sun do **not** accept sunlight alone	1
(ii)	any **one** from: • volume of water • distance between lamp and boiling tube • initial / starting temperature of water • same room temperature	accept amount for volume do **not** accept time or same insulation material	1
(iii)	any **one** from: • greater sensitivity / precision • could link to a computer for (automatic) data analysis • could take more frequent readings • reduces instrument reading error	do **not** accept more reliable (negates mark) accept more accurate do **not** accept easier to use on its own	1
(b)(i)	acts as a control	accept to be able to make a comparison accept to see the difference do **not** accept 'to make it a fair test' OWTTE on its own	1
(ii)	(plastic) <u>foam</u> and aluminium foil		1

Continued on next page

4.1.2.1 Energy transfers in a system

Answer 06 · Mark scheme

question	answers	extra information	mark
(iii)	(aluminium) <u>foil</u> is a <u>poor</u> absorber of thermal radiation **or** (aluminium) <u>foil</u> is a (good) reflector of thermal radiation	accept heat / infra red for thermal radiation do **not** accept 'reflects sunlight' on its own	1
	(plastic) <u>foam</u> traps air which is a (good) insulator	accept (plastic) foam is a poor conductor / (good) insulator do **not** accept 'the material' is a good insulator / poor conductor	1
(c)	particles vibrate with a bigger / stronger amplitude / faster / with more (kinetic) energy	accept particles vibrate more do **not** accept <u>start</u> to vibrate only	1
	energy transferred by <u>collisions</u> with other particles	do **not** accept answers in terms of free/mobile electrons	1
total			9

4.1.2.1 Energy transfers in a system

Answer 07 · Mark scheme

March 2007 | PHY1A | Original Q3 | Legacy

Three	**A**	conduction	**3**
	B	convection	**4**
	C	radiation	**1**
	D	reflection	**2**

Answer 08 · 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**

4.1.2.1 Energy transfers in a system

Answer 09 · Mark scheme June 2007 | PHY1A | Original Q1 | Legacy

Question	Key		
One	**A**	chemical	**1**
	B	electrical	**2**
	C	kinetic	**3**
	D	thermal	**4**

Answer 10 · Mark scheme June 2007 | PHY1A | Original Q2 | Legacy

Two	**A**	conduction	**1**
	B	convection	**3**
	C	insulation	**4**
	D	radiation	**2**

Answer 11 · Mark scheme June 2007 | PHY1A | Original Q6 | Legacy

Six	**A**	conclusion	**4**
	B	control variable	**2**
	C	dependent variable	**3**
	D	independent variable	**1**

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

Answer 12 · Mark scheme June 2007 | PHY1A | Original Q8 | Legacy

Eight	**4**	**3**	**1**	**2**

Answer 13 · Mark scheme June 2007 | PHY1F | Original Q3 | Legacy

The full source mark scheme begins on page 84. Follow original question 3 in that document.

Answer 14 · Mark scheme November 2007 | PHY1A | Original Q4 | Legacy

Four	**A**	the method that costs most to install	**3**
	B	the method that conserves most energy	**1**
	C	the method that pays for itself in less than one year	**2**
	D	the method that takes five years to pay for itself	**4**

4.1.2.1 Energy transfers in a system

Answer 15 · Mark scheme

March 2008 | PHY1AP | Original Q1 | Legacy

Question	Key		
One	**A**	conduction	**3**
	B	convection	**2**
	C	insulation	**4**
	D	radiation	**1**

Answer 16 · Mark scheme

June 2008 | PHY1AP | Original Q3 | Legacy

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

Answer 17 · Mark scheme

November 2008 | PHY1AP | Original Q1 | Legacy

Question	Key		
One	**A**	electrical	**1**
	B	heat	**4**
	C	light	**2**
	D	sound	**3**

Answer 18 · Mark scheme

November 2008 | PHY1AP | Original Q3 | Legacy

Three	**A**	conduction	**1**
	B	convection	**3**
	C	insulation	**2**
	D	radiation	**4**

Answer 19 · Mark scheme

November 2008 | PHY1AP | Original Q9 | Legacy

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

4.1.2.1 Energy transfers in a system

Answer 20 · Mark scheme

March 2009 | PHY1AP | Original Q5 | Legacy

Five	**A** conduction **1** **B** convection **2** **C** insulation **4** **D** radiation **3**			
	A	**B**	**C**	**D**

Answer 21 · Mark scheme

March 2009 | PHY1AP | Original Q7 | Legacy

Seven	**3**	**2**	**4**	**1**

Answer 22 · Mark scheme

March 2009 | PHY1AP | Original Q9 | Legacy

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

4.1.2.1 Energy transfers in a system

Answer 22 · Mark scheme

March 2009 | PHY1AP | Original Q9 | Legacy

SCIENCE A (4461)/PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

March 2009

Higher Tier

Question	Key		
One	**A**	conduction	**1**
	B	convection	**2**
	C	insulation	**4**
	D	radiation	**3**
Two	**A**	generator	**2**
	B	grid	**4**
	C	transformer	**3**
	D	turbine	**1**

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

4.1.2.1 Energy transfers in a system

Answer 23 · Mark scheme June 2009 | PHY1AP | Original Q3 | Legacy

Three	**A**	conduction	**4**
	B	convection	**1**
	C	insulation	**2**
	D	radiation	**3**

Answer 24 · Mark scheme June 2009 | PHY1AP | Original Q4 | Legacy

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

Answer 25 · Mark scheme June 2009 | PHY1AP | Original Q6 | Legacy

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

Answer 26 · Mark scheme November 2009 | PHY1AP | Original Q9 | Legacy

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

Answer 27 · Mark scheme March 2010 | PHY1AP | Original Q1 | Legacy

Question			***Key***
One	**A**	conduction	**4**
	B	convection	**3**
	C	insulation	**2**
	D	radiation	**1**

Answer 28 · Mark scheme June 2010 | PHY1AP | Original Q2 | Legacy

Two	**A**	conduction	**4**
	B	convection	**3**
	C	insulation	**1**
	D	radiation	**2**

Answer 29 · Mark scheme June 2010 | PHY1AP | Original Q7 | Legacy

Seven	2	3	1	2

4.1.2.1 Energy transfers in a system

Answer 30 · Mark scheme

June 2019 | PHY1F | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)(i)	walls	accept sides (of house)	1
4(a)(ii)	fit double glazing **or** close / fit curtains / fit shutters	accept close windows accept keep house at a lower temperature accept fit (foam) draft excluders around the windows / in the jams accept put plastic (film) across the windows do **not** accept fit thicker glass	1
4(b)(i)	cavity (wall insulation)	accept the middle one	1
4(b)(ii)	fit hot water jacket **and** draught-proofing (together) saves most money	both required only scores if first mark scores accept saves more than fitting (energy efficient) light bulbs accept saves £40 accept gives the shortest payback time an answer fit energy efficient light bulbs (on its own) gains **1** mark only	1 1
Total			**5**

4.1.2.1 Energy transfers in a system

Answer 30 · Mark scheme June 2010 | PHY1F | Original Q4 | Legacy

PHY1F

4.1.2.1 Energy transfers in a system

Answer 31 · Mark scheme

June 2010 | PHY1F | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)	conduction		1
6(b)(i)	any **one** from: • starting temperature (of cold water) • pipe length • pipe diameter • pipe (wall) thickness • volume of cold water • temperature of hot water (in) • time	temperature is insufficient accept size of pipe accept amount for volume	1
6(b)(ii)	(type of) material is categoric	accept one variable is categoric accept variable(s) are categoric accept it is categoric accept variable(s) are not continuous descriptions of variables ie names and numbers is insufficient	1
6(b)(iii)	copper greatest temperature change	only scores if copper chosen accept heat for temperature accept heated water the fastest accept it was hottest (after 10 minutes) accept it is the best / a good conductor	1 1

Question 6 continues on the next page . . .

4.1.2.1 Energy transfers in a system

Answer 31 · Mark scheme

PHY1F

Question 6 continued . . .

question	answers	extra information	mark
6(c)	larger (surface) area	accept the pipe is longer accept hot (dirty) water (inside pipe) is in contact with the cold water (outside pipe) for a longer time the pipe is a spiral is insufficient	1
Total			**6**

4.1.2.1 Energy transfers in a system

Answer 31 · Mark scheme June 2010 | PHY1F | Original Q6 | Legacy

PHY1F

Answer 32 · Mark scheme November 2010 | PHY1AP | Original Q1 | Legacy

Question			Key
One	**A**	conduction	**2**
	B	insulation	**3**
	C	radiation	**1**
	D	reflection	**4**

Answer 33 · Mark scheme November 2010 | PHY1AP | Original Q3 | Legacy

Three	**A**	chemical	**1**
	B	electrical	**3**
	C	heat	**4**
	D	kinetic	**2**

Answer 34 · Mark scheme November 2010 | PHY1AP | Original Q7 | Legacy

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

4.1.2.1 Energy transfers in a system

Answer 35 · Mark scheme

January 2011 | PHY1F | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)(i)	convection		1
4(a)(ii)	conduction		1
4(b)(i)	2 black is the best <u>absorber</u> (of thermal energy / heat)	 accept black is the best emitter (of thermal energy / heat) note that a comparative is needed (eg better or best)	1 1
4(b)(ii)	the colour of the metal plates		1
4(b)(iii)	any **one** from: • more precise / accurate / reliable • can measure continuously • take many readings in a small time • removes (human) reading error • can compare / draw graphs automatically • records data automatically	 do **not** accept better reading do **not** accept thermometer is unreliable accept easier to read	1
4(c)(i)	radiation	accept radiates accept infra red (IR) waves do **not** accept heat waves	1

Question 4 continues on the next page . . .

PHY1F

Question 4 continued . . .

question	answers	extra information	mark
4(c)(ii)	to reflect (heat away from the fire fighter)	accept it reflects accept it is a poor absorber (of thermal radiation / heat) do **not** accept deflect / bounce for reflect	1
4(d)	**N** transfers / absorbs less heat **or** gives smallest increase in temperature	the mark is for the reason which does not score if **M** is chosen accept will keep fire fighters cooler accept **N** is cooler (after 15 minutes) an answer **N** goes up to 52°C and **M** goes up to 100°C is insufficient	1
Total			**9**

4.1.2.1 Energy transfers in a system

Answer 35 · Mark scheme January 2011 | PHY1F | Original Q4 | Legacy

PHY1F

Answer 36 · Mark scheme March 2011 | PHY1AP | Original Q2 | Legacy

Two	**A**	conduction	**1**
	B	convection	**2**
	C	insulation	**4**
	D	radiation	**3**

Answer 37 · Mark scheme March 2011 | PHY1AP | Original Q9 | Legacy

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

4.1.2.1 Energy transfers in a system

Answer 37 · Mark scheme

March 2011 | PHY1AP | Original Q9 | Legacy

GCSE

SCIENCE A (4461) / PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

March 2011

Higher Tier

Question	Key		
One	**A**	economical	**2**
	B	efficient	**1**
	C	environmental	**3**
	D	ethical	**4**
Two	**A**	. . . increase the rate at which infra red radiation is absorbed	**4**
	B	. . . increase the rate at which infra red radiation is emitted	**3**
	C	. . . improve the ability to reflect visible light	**1**
	D	. . . prevent the reflection of visible light	**2**

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

4.1.2.1 Energy transfers in a system

Answer 38 · Mark scheme

June 2011 | PHY2F | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)	brown		1
6(b)	outside / case is plastic / an insulator	accept is double insulated accept non-conductor for plastic do **not** accept it / hairdryer is plastic	1
6(c)(i)	(1) S_1 (2) S_1 and S_3	and no other both required, either order	1 1
6(c)(ii)	S_1 must be ON (for either heater to work) S_1 switches the fan on	do **not** accept reference to 'fan' switch	1 1
6(d)	1495 watt(s) or W	allow **1** mark for correct substitution ie, 6.5 × 230 an answer of 1.495 kW gains **3** marks although the unit is an independent mark for full credit the unit and numerical value must be consistent accept joules per second or J/s	2 1
Total			**9**

4.1.2.1 Energy transfers in a system

Answer 38 · Mark scheme June 2011 | PHY2F | Original Q6 | Legacy

PHY2F

Answer 39 · Mark scheme November 2011 | PHY1AP | Original Q2 | Legacy

Two	**A**	chemical	**1**
	B	electrical	**3**
	C	heat (thermal energy)	**4**
	D	kinetic	**2**

4.1.2.1 Energy transfers in a system

Answer 40 · Mark scheme

January 2013 | PH1FP | Original Q9 | Legacy

Question 9

question	answers	extra information	mark
9(a)(i)	5(.0)		1
9(a)(ii)	35 **or** their (a)(i) × 7 correctly calculated	allow **1** mark for correct substitution, ie 5 **or** their (a)(i) × 7 provided no subsequent step shown	2
9(a)(iii)	525(p) **or** (£) 5.25 **or** their (a)(ii) × 15 correctly calculated	if unit p or £ given they must be consistent with the numerical answer	1
9(a)(iv)	decreases temperature difference (between inside and outside) decreases	 accept gradient (of line) decreases do **not** accept temperature (inside) decreases do **not** accept graph goes down	1 1
9(b)(i)	air (bubbles are) trapped (in the foam) (and so the) air cannot circulate / move / form convection current	do **not** accept air traps heat foam has air pockets is insufficient air is a good insulator is insufficient no convection current is insufficient answers in term of warm air from the room being trapped are incorrect and score no marks	1 1

Question 9 continues on the next page . . .

PH1FP

Question 9 continued . . .

question	answers	extra information	mark
9(b)(ii)	how effective / good a material is as an insulator / at keeping energy in	accept heat for energy accept the lower the U-value the better the insulator accept the lower the U-value the lower the rate of energy / heat transfer	1
9(c)	it will increase because the glass is not (such) a good insulator (as the wall)	room will be cooler is insufficient the U-value has increased is insufficient	1 1
Total			**11**

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

4.1.2.1 Energy transfers in a system

Answer 41 · Mark scheme

June 2013 | PH1FP | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)(i)	temperature (increase) and time switched on are <u>directly proportional</u>	accept the idea of equal increases in time giving equal increases in temperature answers such as: • as time increases, temperature increases • positive correlation • linear relationship • temperature and time are proportional score **1** mark	2
6(a)(ii)	any **one** from: • energy transfer (from the block) to the surroundings • (some) energy used to warm the heater / thermometer (itself) • (metal) block is not insulated	"it" refers to the metal block accept lost for transfer accept air for surroundings accept takes time for heater to warm up	1
6(a)(iii)	15 000	allow **1** mark for correct substitution, ie 50 × 300 provided no subsequent step shown	2
6(b)	lead needs least energy to raise temperature by 1°C	reason only scores if lead is chosen accept needs less energy to heat it (by the same amount) lowest specific heat capacity is insufficient	1 1

Question 6 continues on the next page . . .

PH1FP

Question 6 continued . . .

question	answers	extra information	mark
6(c)(i)	convection conduction	correct order only	1 1
6(c)(ii)	¾ (year) **or** 0.75 **or** 9 months **or** 274 days	allow **1** mark for correct method, ie $\frac{12}{16}$ shown	2
Total			**11**

4.1.2.1 Energy transfers in a system

Answer 41 · Mark scheme

June 2013 | PH1FP | Original Q6 | Legacy

PH1FP

4.1.2.1 Energy transfers in a system

Answer 42 · Mark scheme June 2014 | PH1FP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO spec ref
1(a)(i)	electrical kinetic sound	correct order only	1 1 1	AO1 1.2
1(a)(ii)	transferred into surroundings / atmosphere	accept warms the surroundings allow released into the environment becomes heat or sound is insufficient	1	AO1 1.2.1c
1(b)	0.7 / 70 %	an answer of 70 without % or with the wrong unit **or** 0.7 with a unit gains **1** mark	2	AO2 1.2.1d
Total			**6**	

4.1.2.1 Energy transfers in a system

Answer 43 · Mark scheme June 2014 | PH1FP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO spec ref
3(a)	solid		1	AO1 1.1.3a
3(b)	decreased decreased increased	correct order only	1 1 1	AO1 1.1.3a
3(c)(i)	A uses least / less energy (in 1 year)	reason only scores if A chosen a comparison is required accept uses least power accept uses least kWh	1 1	AO2 AO3 1.3.1b
3(c)(ii)	greater the volume the greater the energy it uses (in 1 year)		1	AO3 1.1.3
3(c)(iii)	a very small number sampled	accept only tested 3 accept insufficient evidence / data allow not all fridges have the same efficiency **or** a correct description implying different efficiencies only tested each fridge once is insufficient there are lots of different makes is insufficient	1	AO3 1.1.3
Total			**8**	

4.1.2.1 Energy transfers in a system

Answer 44 · Mark scheme

Question	Answers	Extra information	Mark	AO spec ref
5(a)(i)	any **two** from: • mass (of block) • starting temperature • final / increase in temperature • voltage / p.d. • power (supplied to each block) • type / thickness of insulation	accept weight for mass temperature is insufficient same power supply insufficient same insulation insufficient	2	AO2 4.3.2a
5(a)(ii)	one of variables is categoric **or** (type of) material is categoric	accept the data is categoric accept a description of categoric do **not** accept temp rise is categoric	1	AO3 4.4.2c
5(a)(iii)	concrete (heater on for) longest / longer time	reason only scores if concrete chosen a long time or quoting a time is insufficient do **not** accept it is the highest bar	1 1	AO2 AO3 1.3.1c
5(a)(iv)	4500 (J)	allow **1** mark for correct substitution ie 2 × 450 × 5 provided no subsequent step shown	2	AO2 1.1.4d

Question 5 continues on the next page . . .

Question 5 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
5(b)(i)	point at 10 minutes identified		1	AO3 1.1.4
5(b)(ii)	line through all points except anomalous	line must go from at least first to last point	1	AO2 1.1.4
5(b)(iii)	20 (°C)	if 20^0C is given, award the mark. If an answer other than 20^0C is given, look at the graph. If the graph shows a correct extrapolation of the candidate's best-fit line and the intercept value has been correctly stated, allow 1 mark.	1	AO3 1.1.4
5(b)(iv)	2 (minutes)		1	AO3 1.1.4
Total			**11**	

4.1.2.1 Energy transfers in a system

Answer 45 · Mark scheme June 2015 | PH1FP | Original Q3 | Legacy

The full source mark scheme begins on page 96. Follow original question 3 in that document.

Answer 46 · Mark scheme June 2015 | PH1FP | Original Q4 | Legacy

The full source mark scheme begins on page 96. Follow original question 4 in that document.

Answer 47 · Mark scheme June 2015 | PH1FP | Original Q7 | Legacy

The full source mark scheme begins on page 96. Follow original question 7 in that document.

4.1.2.1 Energy transfers in a system

Answer 48 · Mark scheme

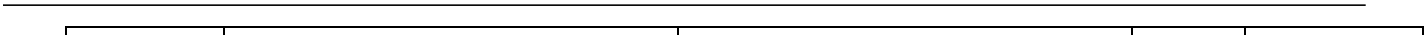
June 2017 | PH1FP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)	radiation conduction		1 1	AO2 1.1.3a 1.1.3c
1(b)	biofuel		1	AO1 1.4.1a
1(c)	83 600 000 (J)	accept 83600 kJ or 83.6 MJ allow **1** mark for correct substitution provided no subsequent step ie E = 250 x 880 x 380	2	AO2 1.1.4d
Total			**5**	

4.1.2.1 Energy transfers in a system

Answer 48 · Mark scheme

June 2017 | PH1FP | Original Q1 | Legacy



4.1.2.1 Energy transfers in a system

Answer 49 · 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**

4.1.2.1 Energy transfers in a system

Answer 50 · 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

4.1.2.1 Energy transfers in a system

Answer 50 · Mark scheme

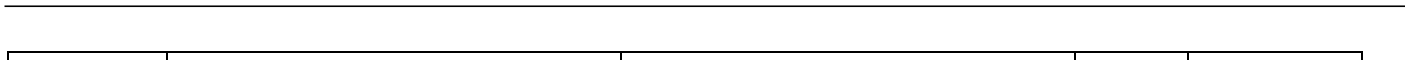
June 2018 | 8463/1F | Original Q8

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**	

4.1.2.1 Energy transfers in a system

Answer 50 · Mark scheme

June 2018 | 8463/1F | Original Q8



4.1.2.1 Energy transfers in a system

Answer 51 · Mark scheme

June 2019 | 8463/1F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8.1	To reduce energy transfer to the surroundings		1	4.1.1.3 RP1 AO1
8.2	scald / burn (to skin)	ignore risk of electric shock	1	4.1.1.3 RP1 AO3
8.3	1 °C		1	4.1.1.3 RP1 AO3
8.4	0.06 kg		1	4.1.1.3 RP1 AO1
8.5	26 400 = 0.20 × c × 30 $c = \frac{26\,400}{(0.20 \times 30)}$ **or** $c = \frac{26\,400}{6}$ c = 4400 J / kg °C	a numerical answer of 4400 scores **3** marks	1 1 1 1	4.1.1.3 RP1 AO2 AO1
Total			**8**	

4.1.2.1 Energy transfers in a system

Answer 52 · Mark scheme

June 2019 | 8463/1F | Original Q10

Question 10

Question	Answers		Mark	AO/ Spec. Ref
10.1	**Level 3**: The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.		5–6	RP2 WS2.2 4.1.2.1 AO1
	Level 2: The design/plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.		3–4	
	Level 1: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.		1–2	
	No relevant content		0	
	Indicative content • Wrap N layers of newspaper around the metal can • Heated water in a kettle **or** Using a Bunsen burner • Put hot water in the metal can • Use a measuring cylinder to measure the volume of water • Measure initial and final temperature with the digital thermometer • Use a stopclock / stopwatch to measure a time of 5 minutes • Calculate temperature decrease • Repeat with different number of layers of newspaper • Repeat with no layers of newspaper • Use same initial temperature of hot water • Use same volume of water each time Level 3: Workable method which includes changing the number of layers and includes at least one control variable (same volume of water or same starting temperature)			
10.2	the digital thermometer and the datalogger have the same resolution	allow both measure to 1 d.p. ignore accuracy ignore precision they give the same result is insufficient	1	RP2 WS2.3 4.1.2.1 AO3
	only need to measure the start and end temperature **or** only need 2 readings **or** only need to calculate the temperature change		1	
Total			**8**	

Answer 53 · Mark scheme

June 2022 | 8463/1F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	0.1 ºC		1	AO3 4.1.2.1 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	a bigger		1	AO3 4.1.2.1 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	identifies 75 (ºC) **and** 62.5 (ºC)		1	AO2 4.1.1.3 RPA2
	$\Delta\theta$ = 12.5 (ºC)	allow a correct calculation of temperature change from misread values	1	
	E = 0.12 × 4200 × 12.5	allow a correct substitution using an incorrect temperature change	1	
	E = 6300 (J)	allow an answer consistent with an incorrect temperature change	1	

4.1.2.1 Energy transfers in a system

Answer 53 · Mark scheme

June 2022 | 8463/1F | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	point at 7 minutes for material **X** ringed		1	AO3 4.1.2.1 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	any **two** from: • water wrapped in material X cooled more slowly • material X is a better insulator **or** the thermal conductivity of material X is lower • the rate of cooling decreased with time (for both X and Y)	allow converse answers for material Y allow water wrapped in material X transfers less energy to the surroundings (in 10 minutes) allow water wrapped in material X has a higher final temperature allow material X is a worse (thermal) conductor allow temperature decreased with time (for both X and Y)	2	AO3 4.1.2.1 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	the rate of cooling would be lower		1	AO3 4.1.2.1 RPA2

4.1.2.1 Energy transfers in a system

Answer 53 · Mark scheme

June 2022 | 8463/1F | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.7	the temperature would be higher		1	AO3 4.1.2.1 RPA2

Total Question 8		**11**

4.1.2.1 Energy transfers in a system

Answer 54 · Mark scheme

June 2023 | 8463/1F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	using the funnel was a safety precaution		1	AO3 4.1.2.1 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	bottle **A** was the control		1	AO3 4.1.2.1 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	stopclock / stopwatch	allow clock / watch ignore timer	1	AO3 4.1.2.1 RPA2

4.1.2.1 Energy transfers in a system

Answer 54 · Mark scheme

June 2023 | 8463/1F | Original Q5

Question	Answers	Mark	AO / Spec. Ref.
05.4	**Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO3 4.1.2.1 RPA2
	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 • use the same (start) temperature for each experiment • use the same number of layers of insulation **or** use the same thickness of insulation • so that temperature difference can be compared • use the same volume of water • so (total thermal) energy of water is the same (each time) **or** so the same area of the bottle surface is heated by the water • use a lid for each bottle • so evaporation is reduced / stopped **or** so energy loss from the water (surface) is reduced / stopped • repeat the investigation and calculate mean values • so anomalous results can be identified **or** so the effect of random errors is reduced		

4.1.2.1 Energy transfers in a system

Answer 54 · Mark scheme

June 2023 | 8463/1F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	bar (chart / graph) (type of) insulation is not numerical values **or** (type of) insulation is labels / categories	 allow one variable is not numerical values allow one variable is not continuous allow (type of) insulation is not continuous allow one variable is labels / categories allow one variable is categoric allow (type of) insulation is categoric MP2 dependent on scoring MP1	1 1	AO2 4.1.2.1 RPA2

Total Question 5	9

4.1.2.1 Energy transfers in a system

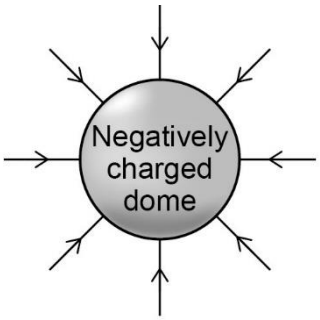
Answer 55 · Mark scheme

June 2024 | 8463/1F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	negative		1	AO1 4.2.5.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	repulsion		1	AO1 4.2.5.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3			1	AO1 4.2.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	resistance		1	AO1 4.2.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	ionised		1	AO1 4.2.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	electrons		1	AO1 4.2.5.2

4.1.2.1 Energy transfers in a system

Answer 55 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	energy transferred = 0.000 002 × 300 000 energy transferred = 0.6 (J)		1 1	AO2 4.2.4.2

Total Question 1	**8**

4.1.2.1 Energy transfers in a system

Answer 56 · Mark scheme

June 2025 | 8463/1F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	x-axis labelled: (type of) metal 4 bars correctly drawn	 allow a tolerance of ± ½ a small square allow **1** mark for 2 or 3 bars drawn correctly	1 2	AO2 4.1.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	copper least time for drawing pin to fall **or** least time for wax to melt	 dependent on MP1 allow less for least allow pin fell off quicker allow quickest time to melt the wax	1 1	AO3 4.1.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	$c = \frac{132}{(0.015 \times 20)}$ c = 440 (J/kg °C)		1 1	AO2 4.1.1.3 4.3.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	power = $\frac{\text{energy transferred}}{\text{time}}$ **Or** $P = \frac{E}{t}$		1	AO1 4.2.4.2 4.1.1.4

4.1.2.1 Energy transfers in a system

Answer 56 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	$0.33 = \frac{132}{t}$ $t = \frac{132}{0.33}$ $t = 400$ (s)		1 1 1	AO2 4.2.4.2 4.1.1.4

Total Question 2	11

Version 1.0: *27092005*

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

4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

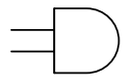
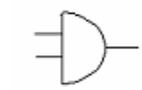
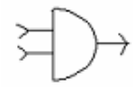
3451/F Q9

question	answers	extra information	mark
(a)	capacitor	accept condenser	1
	LDR	**or** light dependent resistor accept 'ldr', 'Ldr' etc.	1
	relay (normally open)	do **not** accept 'relay normally closed'	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…

4.1.2.1 Energy transfers in a system

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

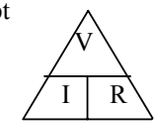
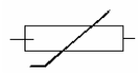
4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

3451/F Q11

question	answers	extra information	mark
(a)(i)	$A_1 = 0.5$ $A_4 = 0.5$	ignore any units allow **1** mark for $A_1 = A_4 \neq 0.5$	1 1
(ii)	the resistance of **P** is more than 20 Ω a smaller current goes through P / A_2 (than 20 Ω)	 dependent on getting 1st mark correct accept converse	1 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)	thermistor or  resistance goes down (as temperature of thermistor goes up)	accept correct circuit symbol allow phonetic spelling 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 1
total			10

4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

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: • <u>increased</u> speed • <u>reduced</u> braking force • <u>slower</u> (driver) reactions • <u>poor</u> vehicle maintenance • <u>increased</u> mass / weight of vehicle • <u>poor</u> road surface • <u>more</u> 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 <u>increase</u> award **1** mark only	3
total			13

4.1.2.1 Energy transfers in a system

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

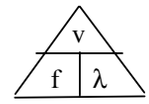
4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

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

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.

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

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

4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

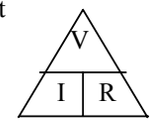
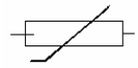
Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

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

4.1.2.1 Energy transfers in a system

3462/3F Q9

question	answers	extra information	mark
(a)(i)	$A_1 = 0.5$ $A_4 = 0.5$	ignore any units allow **1** mark for $A_1 = A_4 \neq 0.5$	1 1
(ii)	the resistance of **P** is more than 20 Ω a smaller current goes through P / A_2 (than 20 Ω)	 dependent on getting 1st mark correct accept converse	1 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)	thermistor or  resistance goes down (as temperature of thermistor goes up)	accept correct circuit symbol allow phonetic spelling 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 1
total			10

4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

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 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

4.1.2.1 Energy transfers in a system

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

3462/3F Q12

question	answers	extra information	mark
(a)(i)	<u>constant</u> 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 = <u>change in velocity</u> 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 <u>no</u> friction	1

cont…

4.1.2.1 Energy transfers in a system

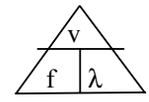
3462/3F Q12 cont…

(d)	any **three** from: • <u>increased</u> speed • <u>reduced</u> braking force • <u>slower</u> (driver) reactions • <u>poor</u> vehicle maintenance • <u>increased</u> mass / weight of vehicle • <u>poor</u> road surface • <u>more</u> 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 <u>increase</u> award **1** mark only	3
total			13

4.1.2.1 Energy transfers in a system

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

Version 1.0: 0707

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1F Unit Physics 1

Mark Scheme

2007 examination - June series

4.1.2.1 Energy transfers in a system

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Dr Michael Cresswell, Director General.

4.1.2.1 Energy transfers in a system

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.

4.1.2.1 Energy transfers in a system

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.

4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

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 accept line is less steep	1
(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

4.1.2.1 Energy transfers in a system

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 greater 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

4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

AQA

GCSE

Science A / Physics

PH1FP

Mark scheme

4405/4403
June 2015

Version/Stage: 1.0 Final

4.1.2.1 Energy transfers in a system

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' 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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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 Assessment Objectives and specification content that each question is intended to cover.

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 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

3.1 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.

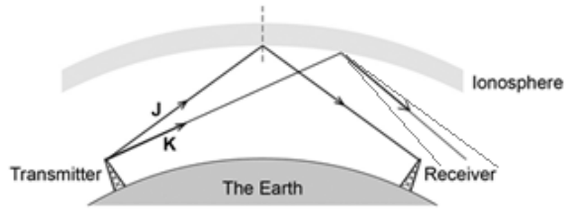
Students will be required to:
- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

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

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	

4.1.2.1 Energy transfers in a system

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**	

4.1.2.1 Energy transfers in a system

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**	

4.1.2.1 Energy transfers in a system

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**	

4.1.2.1 Energy transfers in a system

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**	

4.1.2.1 Energy transfers in a system

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

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**	

4.1.2.1 Energy transfers in a system

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

4.1.2.1 Energy transfers in a system

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**	

4.1.2.1 Energy transfers in a system

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 . . .

4.1.2.1 Energy transfers in a system

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

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**	

4.1.2.1 Energy transfers in a system

Answer 53 · Examiner comments

June 2022 | 8463/1F | Original Q8

Question 8 (Low and standard demand)

08.1 25% of students identified the correct resolution.

08.2 90% of students answered this question correctly.

08.3 Students struggled to interpret the scale on the graph so often didn't score the first marking point, but could score the remaining 3 provided their calculation was correct. Students who used the final temperature (62.5 °C) in place of the temperature change (12.5 °C) could have scored 2 marks for correct use of the equation, which would lead to an answer of 31 500 J. A fair number of students multiplied 0.12 and 4200, scoring no marks. If a student included a negative sign in front of their value for energy, it was ignored. 40% of students scored all 4 marks.

8.4 90% of students identified the anomalous result.

8.5 Some students seemed to think that the conclusion they were asked for related to the anomaly, rather than all the data on the graph, so suggested improvements rather than conclusions. Many students stated the converse conclusion for the second conclusion scoring only 1 mark. 20% of students scored 2 marks, while about 45% of students scored 1 mark.

Please note there is no reference to 08.6 or 08.7

4.1.2.1 Energy transfers in a system

Answer 54 · Examiner comments June 2023 | 8463/1F | Original Q5

Question 5 (Low Demand)

05.1 75% of students correctly identified the reason for using the funnel.

05.2 40% of students correctly identified the reason for not using insulation..

05.3 Well answered with 88 % of students scoring the mark. Answers of 'timer' were ignored, which means if a student wrote ' timer or stop-clock' they would score the mark.

05.4 Many students identified one or two ways to improve the experiment but very few could give a valid reason for why it would be an improvement. 32 % of students scored 2 marks, while 34% of students scored 1 mark. 'Same amount of insulation' was creditworthy, as was 'same amount of water'. Any suggested change followed by the reason 'it is more accurate' was insufficient to score the explanation mark.

05.5 71% of students scored 1 mark by choosing ' bar chart / graph', while only 4% of students scored 2 marks. Common answers which were insufficient were 'easier to read' and 'see the results more clearly'. 'Data is categoric' or 'data is not continuous' were creditworthy reasons which scored the second marking point.

Answer 55 · Examiner comments June 2024 | 8463/1F | Original Q1

Question 1 (Low Demand)

01.1 Only 38% of students scored a mark for knowing that when a person touches a negatively charged metal dome they also become negatively charged.

01.2 55% of students scored a mark for this question about the force of repulsion between like charges.

01.3 Only 29% of students scored a mark for this question. The majority of wrong answers chose the diagram for the electric field around a positively charged dome.

01.4 62% of students chose the correct answer, knowing that an insulator has a high resistance. The most common incorrect answer was temperature.

01.5 67% of students answered this question correctly, knowing that a spark jumps when the air is ionised.

01.6 78% of students answered this question correctly, identifying electrons as the particle transferred when a spark jumps between two objects.

01.7 93% of students calculated the energy transferred correctly.

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4.1.2.1 Energy transfers in a system

Answer 56 · Examiner comments June 2025 | 8463/1F | Original Q2

02.1

Most of the students scored 2 marks for plotting the bars correctly. Students scored 1 mark if they plotted points rather than bars. Many students did not label the x-axis. Students who labelled it but did not score usually labelled the x-axis and the y-axis 'x' and 'y'. Almost 60 % of the students scored all 3 marks.

02.2

Just under half of the students scored 2 marks for choosing copper and giving a valid reason, while 10 % of the students scored only 1 mark with a reason that was insufficient or incorrect. Many students chose steel as it took the greatest time to melt the wax.

02.3

Almost 90 % of the students scored 2 marks on this SHC calculation. Students who scored only the substitution mark usually did not put the denominator in brackets when entering the calculation in their calculator.

02.4

Nearly all of the students chose the correct equation from the equations sheet. A mixture of quantities and symbols scored the mark. Upper case or lower-case letters scored the mark. Equation triangles were insufficient to score the mark.

02.5

About 5 % of the students scored the substitution mark but then failed to rearrange correctly.

4.1.2.1 Energy transfers in a system

AQA

GCSE
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4.1.2.1 Energy transfers in a system

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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.

4.1.2.1 Energy transfers in a system

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.

4.1.2.1 Energy transfers in a system

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.