AQA GCSE Physics | 8463

SPECIFICATION POINT 4.7.3.2

Uses of the generator effect (HT only)

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**46**
Available paper years	**2004–2024**

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.

4.7.3.2 Uses of the generator effect (HT only)

Answer 01 · Mark scheme June 2004 | 3451H | Original Q11 | Legacy

The full source mark scheme begins on page 55. Follow original question 11 in that document.

Answer 02 · Mark scheme June 2004 | 3462H3 | Original Q9 | Legacy

The full source mark scheme begins on page 76. Follow original question 9 in that document.

Answer 03 · Mark scheme November 2006 | PHY1A | Original Q7 | Legacy

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

Answer 04 · Mark scheme June 2007 | PHY1A | Original Q4 | Legacy

Four	**3**	**3**	**3**	**1**

Answer 05 · Mark scheme June 2007 | PHY1A | Original Q5 | Legacy

Five	**1**	**3**	**3**	**3**

4.7.3.2 Uses of the generator effect (HT only)

Answer 06 · Mark scheme June 2007 | PHY1A | Original Q9 | Legacy

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

Answer 07 · Mark scheme November 2007 | PHY1A | Original Q2 | Legacy

Two	**A**	battery	**4**	
	B	buoy	**1**	
	C	generator	**3**	
	D	turbine	**2**	
	A	**B**	**C**	**D**

Answer 08 · Mark scheme November 2007 | PHY1A | Original Q5 | Legacy

Five	**2**	**3**	**2**	**4**

Answer 09 · Mark scheme November 2007 | PHY1A | Original Q8 | Legacy

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

Answer 10 · Mark scheme March 2008 | PHY1AP | Original Q2 | Legacy

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

4.7.3.2 Uses of the generator effect (HT only)

Answer 11 · Mark scheme

March 2008 | PHY1AP | Original Q6 | Legacy

Six	**A** house	**4**		
	B power station	**1**		
	C step-down transformer	**3**		
	D step-up transformer	**2**		
	A	**B**	**C**	**D**

4.7.3.2 Uses of the generator effect (HT only)

Answer 12 · Mark scheme

June 2008 | PHY3H | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
(a)	any **two** points: • humans cannot hear ultrasound • it has a very high frequency / pitch • above the (upper) limit for humans / above 20 000 Hz	do **not** credit features which are true of sound in general eg longitudinal waves do **not** credit just 'has a high frequency / pitch'	2
(b)(i)	ultrasound / waves are reflected Pulse **A** indicates / is the crack Pulse **B** *i*ndicates / is the back (of the block or crack)	… are bounced is insufficient, but … echo is acceptable need to mention both A and B to get this mark	1 1
(b)(ii)	90 (mm)	accept any answer in the range 88 – 92 (mm)	1
total			5

4.7.3.2 Uses of the generator effect (HT only)

Answer 12 · Mark scheme June 2008 | PHY3H | Original Q5 | Legacy

PHY3H

4.7.3.2 Uses of the generator effect (HT only)

Answer 13 · Mark scheme

June 2008 | PHY3H | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
	coil cuts through the magnetic field **or** 'conductor cuts through the lines of force' **or** 'conductor cuts through the space between the magnets / poles'		1
	a potential difference is induced (across ends of the coil)	do **not** credit idea that potential difference flows in coil	1
	coil is part of a circuit		1
	potential difference causes a current in the circuit / lamp	allow 'this / the voltage causes a current in the circuit / lamp'	1
	slip rings and brushes enable the coil to be connected **without twisting** the leads / wires	do **not** credit just 'so the lamp lights'	1
total			5

4.7.3.2 Uses of the generator effect (HT only)

Answer 13 · Mark scheme June 2008 | PHY3H | Original Q7 | Legacy

PHY3H

Answer 14 · Mark scheme November 2008 | PHY1AP | Original Q7 | Legacy

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

4.7.3.2 Uses of the generator effect (HT only)

Answer 15 · Mark scheme

Question 4

question	answers	extra information	mark
4(a)(i)	(atoms / elements with) the same number of protons but different numbers of neutrons	accept (atoms / elements with) different mass number but same atomic number	1
4(a)(ii)	substances that give out radiation	accept alpha, beta or gamma for radiation accept an unstable nucleus that decays radioactive decay takes place is insufficient	1
4(b)	85 years	± 2 years allow **1** mark for showing correct method on the graph	2
4(c)(i)	a helium nucleus	accept 2 neutrons and 2 protons accept $_2{}^4He$ do **not** accept helium atom	1
4(c)(ii)	the rate of decay (of plutonium) decreases less heat produced	accept fewer (plutonium) nuclei (to decay) accept radioactivity decreases do **not** accept energy for heat	1 1

Question 4 continues on the next page

PHY1H

Question 4 continued

question	answers	extra information	mark
4(d)(i)	(outside the body) alpha (particles) cannot penetrate into the body (inside the body) (heat produced from decay) damages / kills cells / tissues	 accept causes cancer for damages / kills cells / tissues accept **highly** toxic	 1 1
4(d)(ii)	any **one** from: • worried same could happen again • an accident may cause radiation to be spread around the Earth / atmosphere • idea of soil contamination resulting from accident / release of radioactive material • idea of negative effect on health resulting from accident / release of radioactive material	 accept any sensible suggestion	1
Total			**10**

4.7.3.2 Uses of the generator effect (HT only)

Answer 15 · Mark scheme

January 2009 | PHY1H | Original Q4 | Legacy

PHY1H

4.7.3.2 Uses of the generator effect (HT only)

Answer 16 · Mark scheme

Question 4

question	answers	extra information	mark
4(a)	soot /ash/ waste gases pass (negatively) charged grid		1
	soot/ash given a <u>negative</u> charge	accept picks up electrons	1
	soot/ash repelled from (negative) grid **or** soot/ash attracted to (positively charged) metal plates		1
4(b)	charge must increase / build up	accept electrons for charge any reference to positive electrons negates this mark	1
	(producing) a large enough potential difference <u>between</u> dome <u>and</u> (earthed) <u>conductor</u>	accept voltage for pd any reference to positive earth negates this mark	1
Total			**5**

4.7.3.2 Uses of the generator effect (HT only)

Answer 16 · Mark scheme January 2009 | PHY2H | Original Q4 | Legacy

PHY2H

Answer 17 · Mark scheme March 2009 | PHY1AP | Original Q2 | Legacy

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

4.7.3.2 Uses of the generator effect (HT only)

Answer 18 · Mark scheme June 2009 | PHY3H | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)	any **two** from: • to (electrically) connect • stationary and moving parts • without tangling the wires	 accept to complete the circuit accept to allow a current / charge to flow	2
7(b)	current (induced) is reversed / changes in direction / alternates every half turn	accept (induced) p.d. <u>across</u> the coil do **not** accept p.d. <u>in</u> the coil	1 1
7(c)	by rotating / moving a magnetic field / magnet relative to a coil	accept by doing the converse / opposite	1
Total			**5**

4.7.3.2 Uses of the generator effect (HT only)

Answer 19 · Mark scheme

November 2009 | PHY1AP | Original Q7 | Legacy

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

4.7.3.2 Uses of the generator effect (HT only)

Answer 20 · Mark scheme January 2010 | PHY2H | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)	each hair gains the <u>same</u> (type of) charge **or** (each) hair is negatively charged **or** (each) hair gains electrons	do **not** accept hair becomes positively charged	1
	similar charges repel **or** negative charges repel **or** electrons repel	accept positive charges repel providing first marking point is in terms of positive charge	1
5(b)	0.000002 **or** 2×10^{-6} **or** $2\,\mu C$	accept correct substitution and transformation for **1** mark ie 30 / 15 or .03 / 15000 or 30 / 15000 or .03 / 15 answers 2 and 0.002 gain **1** mark	2
5(c)	current	do **not** accept amp / amperes	1
Total			**5**

4.7.3.2 Uses of the generator effect (HT only)

Answer 20 · Mark scheme January 2010 | PHY2H | Original Q5 | Legacy

PHY2H

Answer 21 · Mark scheme March 2010 | PHY1AP | Original Q8 | Legacy

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

Answer 22 · Mark scheme March 2010 | PHY1AP | Original Q9 | Legacy

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

4.7.3.2 Uses of the generator effect (HT only)

Answer 22 · Mark scheme

March 2010 | PHY1AP | Original Q9 | Legacy

SCIENCE A (4461)/PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

March 2010

Higher Tier

Question	Key		
One	**A**	0.25	**4**
	B	60	**3**
	C	100	**1**
	D	240	**2**
Two	**A**	computer monitor	**1**
	B	loudspeaker	**3**
	C	microphone	**2**
	D	solar cell	**4**

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

4.7.3.2 Uses of the generator effect (HT only)

Answer 23 · Mark scheme March 2010 | PHY1BP | Original Q4 | Legacy

Four	**2**	**4**	**2**	**1**

Answer 24 · Mark scheme March 2010 | PHY1BP | Original Q9 | Legacy

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

Answer 25 · Mark scheme June 2010 | PHY1AP | Original Q2 | Legacy

Two	**A**	electricity is produced	**4**	
	B	moving water drives turbines	**2**	
	C	turbines drive generators	**3**	
	D	water collects in a reservoir	**1**	
	A	**B**	**C**	**D**

4.7.3.2 Uses of the generator effect (HT only)

Answer 26 · Mark scheme

June 2010 | PHY1H | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)(i)	tidal / tides	do **not** accept water / waves	1
5(a)(ii)	any **three** from: • shorter journey time • less pollution from traffic • energy source is free • energy source / tides are predictable • produces less / no pollutant gases (than fuel burning power stations) • conserves supplies of fossil fuels • uses renewable energy (to generate electricity) • provides employment • no visual / noise pollution	accept easier to go from town to town accept less petrol / fuel used accept CO_2 / carbon emissions reduced accept no CO_2 / greenhouse gases produced accept air pollution for pollutant gases less harm to the environment is insufficient the electricity is cheaper is insufficient do **not** accept produces no radioactive waste the pollution mark scores twice only if it is clear one reference is to traffic and the other is to electricity generation	3

Question 5 continues on the next page . . .

4.7.3.2 Uses of the generator effect (HT only)

PHY1H

Question 5 continued . . .

question	answers	extra information	mark
5(b)(i)	(sometimes) electricity demand may be greater than supply (of electricity from the system) **or** can sell (excess) electricity (to the National Grid)	accept in case turbines / generators fail	1
5(b)(ii)	decreases the current reducing energy loss (along cables)	accept increases the voltage accept less heat / thermal energy lost / produced	1 1
Total			**7**

4.7.3.2 Uses of the generator effect (HT only)

Answer 26 · Mark scheme June 2010 | PHY1H | Original Q5 | Legacy

PHY1H

Answer 27 · Mark scheme November 2010 | PHY1AP | Original Q7 | Legacy

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

4.7.3.2 Uses of the generator effect (HT only)

Answer 28 · Mark scheme

January 2011 | PHY1H | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)	any **two** from: **YES** answers may include: • wind produces no pollutant gases • nuclear produces no pollutant gases • (burning) gas does not produce SO_2 **NO** answers may include: • nuclear produces <u>radioactive</u> waste • (burning) gas produces CO_2 / pollutant gases / air pollution	marks are awarded only for the reason but must match the ringed answer for both marks a **MAYBE** answer should include a **YES** and **NO** response answers in terms of the sources being renewable or non-renewable are insufficient accept wind burns no fuel accept CO_2 / SO_2 / oxides of nitrogen / greenhouse gas for pollutant gases accept nuclear burns no fuel accept gas does not cause acid rain do **not** accept they don't / none produce pollutant gases accept contributes to global warming / greenhouse effect	2

Question 3 continues on the next page . . .

4.7.3.2 Uses of the generator effect (HT only)

PHY1H

Question 3 continued . . .

question	answers	extra information	mark
3(b)	nuclear power stations use a non-renewable fuel	accept uranium / plutonium is non-renewable do **not** accept some are unrenewable	1
Total			**3**

4.7.3.2 Uses of the generator effect (HT only)

Answer 28 · Mark scheme January 2011 | PHY1H | Original Q3 | Legacy

PHY1H

4.7.3.2 Uses of the generator effect (HT only)

Answer 29 · Mark scheme

Question 4

question	answers	extra information	mark
4(a)(i)	kinetic	accept KE do **not** accept movement	1
4(a)(ii)	0.75 **or** 75 %	allow **1** mark for correct substitution ie $\frac{60\,000}{80\,000}$ an answer 0.75 % **or** 0.75 with a unit gains **1** mark only an answer 75 with or without a unit gains **1** mark only	2
4(b)	any **one** from: • large areas of land are flooded • peoples homes may be destroyed • habitat (of animals and plants) lost / damaged	 uses large areas of land / takes up large areas of land is insufficient construct is neutral very noisy is neutral	1

Question 4 continues on the next page . . .

PHY1H

Question 4 continued . . .

question	answers	extra information	mark
4(c)(i)	system of cables <u>and</u> transformers	both required for the mark accept power lines / wires for cables ignore reference to pylons inclusions of power stations / consumers negates answer	1
4(c)(ii)	less energy loss / wasted (in the cables) as the cables are shorter	accept heat for energy do **not** accept no energy loss do **not** accept electricity for energy	1 1
Total			**7**

4.7.3.2 Uses of the generator effect (HT only)

Answer 29 · Mark scheme January 2011 | PHY1H | Original Q4 | Legacy

PHY1H

Answer 30 · Mark scheme March 2011 | PHY1AP | Original Q3 | Legacy

Three	**A**	electrical	**3**
	B	kinetic	**4**
	C	light	**1**
	D	sound	**2**

Answer 31 · Mark scheme June 2011 | PHY1AP | Original Q3 | Legacy

Three	**2**	**1**	**1**	**3**

4.7.3.2 Uses of the generator effect (HT only)

Answer 32 · Mark scheme

June 2011 | PHY3H | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a)	microphone		1
1(b)(i)	vertical line from any maxima or minima to axis	do **not** penalise minor errors but do **not** allow unless intention is clear	1
1(b)(ii)	loudness / volume / intensity / energy	do **not** accept noise	1
1(c)	17	this answer only	1
1(d)	the greater the distance, the smaller the amplitude **or** there is a (strong) negative correlation between distance and amplitude **or** there is an inverse square relationship between distance and amplitude	accept volume / intensity / energy / loudness for amplitude do **not** accept distance and amplitude are inversely proportional	1
1(e)	20 Hz 20,000 Hz	either order accept 20 kHz provided unit has been clearly changed	1 1
Total			**7**

4.7.3.2 Uses of the generator effect (HT only)

Answer 32 · Mark scheme June 2011 | PHY3H | Original Q1 | Legacy

PHY3H

Answer 33 · Mark scheme November 2011 | PHY1AP | Original Q8 | Legacy

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

Answer 34 · Mark scheme November 2011 | PHY1AP | Original Q9 | Legacy

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

The AQA UMS Conversion Calculator can be found at the following web address:

http://www.aqa.org.uk/umsconversion

4.7.3.2 Uses of the generator effect (HT only)

Answer 35 · Mark scheme

January 2013 | PH1HP | Original Q3 | Legacy

Question 3

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

3(b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.			6
0 marks	**Level 1 (1-2 marks)**	**Level 2 (3-4 marks)**	**Level 3 (5-6 marks)**	
No relevant content.	There is a brief description of one advantage **or** disadvantage of using either biogas or wind **or** makes a conclusion with a reason.	There is a description of some advantages **and / or** disadvantages for biogas **and / or** wind **or** there is a direct comparison between the two systems **and** at least one advantage / disadvantage **or** a detailed evaluation of one system only with a conclusion.	There is a clear and detailed comparison of the two systems. There must be a clear conclusion of which system would be best with at least one comparative reason given for the choice made.	

Question 3 continues on the next page . . .

PH1HP

Question 3 continued . . .

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

Total			**9**

4.7.3.2 Uses of the generator effect (HT only)

Answer 35 · Mark scheme

January 2013 | PH1HP | Original Q3 | Legacy

PH1HP

4.7.3.2 Uses of the generator effect (HT only)

Answer 36 · Mark scheme

January 2013 | PH1HP | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)	any **one** from: • energy / source is constant • energy / source does not rely on uncontrollable factors • can generate all of the time	accept a specific example, eg the weather will not run out is insufficient	1
6(b)	(dismantle and) remove radioactive waste / materials / fuel	accept nuclear for radioactive knock down / shut down is insufficient	1
6(c)	any **two** from: • reduce use of fossil fuelled power stations • use more nuclear power • use (more) renewable energy sources • make power stations more efficient • (use) carbon capture (technology)	accept specific fossil fuel accept use less fossil fuel accept build new nuclear power stations accept a named renewable energy source do **not** accept natural for renewable do **not** accept use less non-renewable (energy) sources	2
6(d)	(by increasing the voltage) the current is reduced this reduces the energy / power loss (from the cable) and this increases the efficiency (of transmission)	 accept reduces amount of waste energy accept heat for energy do **not** accept stops energy loss	1 1 1
Total			**7**

4.7.3.2 Uses of the generator effect (HT only)

Answer 36 · Mark scheme

January 2013 | PH1HP | Original Q6 | Legacy

PH1HP

4.7.3.2 Uses of the generator effect (HT only)

Answer 37 · Mark scheme

June 2013 | PH2HP | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)(i)	distance vehicle travels during driver's reaction time	accept distance vehicle travels while driver reacts	1
4(a)(ii)	any **two** from: • tiredness • (drinking) alcohol • (taking) drugs • speed • age	accept as an alternative factor distractions, eg using a mobile phone	2
4(b)(i)	320 000	allow **1** mark for correct substitution, ie $\frac{1}{2} \times 1600 \times 20^2$ provided no subsequent step shown	2
4(b)(ii)	320 000 **or** their (b)(i)		1
4(b)(iii)	40 **or** $\frac{\text{their (b)(ii)}}{8000}$ correctly calculated	allow **1** mark for statement work done = KE lost **or** allow **1** mark for correct substitution, ie 8000 × distance = 320 000 **or** their (b)(ii)	2
4(b)(iv)	any **one** from: • icy / wet roads • (worn) tyres • road surface • mass (of car and passengers) • (efficiency / condition of the) brakes	accept weather conditions accept number of passengers	1

Question 4 continues on the next page . . .

PH2HP

Question 4 continued . . .

question	answers	extra information	mark
4(b)(v)	(work done by) friction (between brakes and wheel)	do **not** accept friction between road and tyres / wheels	1
	(causes) decrease in KE and increase in thermal energy	accept heat for thermal energy accept KE transferred to thermal energy	1
4(c)	the battery needs recharging less often **or** increases the range of the car	accept car for battery accept less demand for other fuels **or** lower emissions **or** lower fuel costs environmentally friendly is insufficient	1
	as the efficiency of the car is increased	accept it is energy efficient	1
	the decrease in (kinetic) energy / work done charges the battery (up)	accept because not all work done / (kinetic) energy is wasted	1
Total			**14**

4.7.3.2 Uses of the generator effect (HT only)

Answer 37 · Mark scheme

June 2013 | PH2HP | Original Q4 | Legacy

PH2HP

4.7.3.2 Uses of the generator effect (HT only)

Answer 38 · Mark scheme June 2014 | PH2HP | Original Q6 | Legacy

6(a)	(same) number of protons	same atomic number is insufficient	1	AO1 2.5.1e
6(b)(i)	nuclei split	do **not** accept atom for nuclei / nucleus	1	AO1 2.6.1b
6(b)(ii)	(nuclear) reactor		1	AO1 2.6.1a
6(c)	beta any **one** from: • atomic / proton number increases (by 1) • number of neutrons decreases / changes by 1 • mass number does not change • a neutron becomes a proton	 accept atomic / proton number changes by 1 (total) number of protons and neutrons does not change	1 1	AO2 2.5.2d
6(d)	(average) time taken for number of nuclei to halve **or** (average) time taken for count-rate / activity to halve		1	AO1 2.5.2h

Question 6 continues on the next page . . .

4.7.3.2 Uses of the generator effect (HT only)

Answer 38 · Mark scheme

Question 6 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
6(e)(i)	6.2 (days)	Accept 6.2 to 6.3 inclusive allow **1** mark for correctly calculating number remaining as 20 000 **or** allow **1** mark for number of 80 000 plus correct use of the graph (gives an answer of 0.8 days)	2	AO2 2.5.2h
6(e)(ii)	radiation causes ionisation that may then harm / kill healthy cells	allow radiation can be ionising accept specific examples of harm, eg alter DNA / cause cancer	1 1	AO3 2.5.2g
6(e)(iii)	benefit (of diagnosis / treatment) greater than risk (of radiation)	accept may be the only procedure available	1	AO3 2.5.2g
Total			**11**	

4.7.3.2 Uses of the generator effect (HT only)

Answer 38 · Mark scheme June 2014 | PH2HP | Original Q6 | Legacy

Question	Answers	Extra information	Mark	AO spec ref

Answer 39 · Mark scheme June 2016 | PH1HP | Original Q2 | Legacy

The full source mark scheme begins on page 93. Follow original question 2 in that document.

4.7.3.2 Uses of the generator effect (HT only)

Answer 40 · Mark scheme

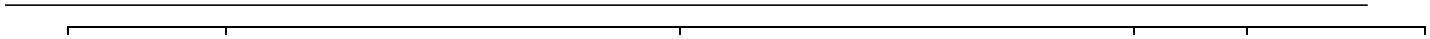
June 2017 | PH1HP | Original Q7 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)	transformer **J** increases the voltage and decreases the current	allow steps up for increases	1	AO1 1.4.2a,b,c
	(so lower current means) less energy wasted **or** less heating of the surroundings	allow heat for energy	1	
	(which) increases efficiency		1	
	(but) transformer **K** decreases the voltage to a safer / appropriate value (for consumers)	allow steps down for decreases if no other mark scored then allow **1** mark for transformer **J** is a step-up transformer <u>and</u> transformer **K** is a step-down transformer	1	
7(b)(i)	at times of low demand (for electricity)		1	AO1 1.4
	when there is a surplus (of electricity)		1	
	water is pumped from low level to high level	accept the turbine acts as a pump **or** the generator acts as a motor	1	
	energy is stored as gravitational potential energy	allow gpe for gravitational potential energy	1	
7(b)(ii)	can store / produce large amount of energy		1	AO1 1.4
	(means) power output increases rapidly	accept short start-up time	1	
Total			**10**	

4.7.3.2 Uses of the generator effect (HT only)

Answer 40 · Mark scheme

June 2017 | PH1HP | Original Q7 | Legacy



4.7.3.2 Uses of the generator effect (HT only)

Answer 41 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2.1	metre rule	allow metre ruler allow tape measure do not accept ruler do not accept metre stick	1	AO1/2 4.6.1.2 RPA8
2.2	(wave) speed = frequency × wavelength	allow v = f λ	1	AO1/1 4.6.1.2 RPA8
2.3	 80cm = 0.8m v = 55 × 0.8 v = 44 (m/s)	an answer of 44 (m/s) scores **3** marks this mark may be awarded if wavelength is incorrectly or not converted allow correct calculation using an incorrectly or not converted wavelength an answer of 4400 (m/s) scores **2** marks	 1 1 1	AO2/1 4.6.1.2 RPA8
2.4	move the (wooden) bridge to the right OR change the mass/weight (on the string) scores **1** mark add more masses/weights (to the string) scores both marks	 dependent on 1st mp being scored	1 1	AO2/2 4.6.1.2 RPA8

4.7.3.2 Uses of the generator effect (HT only)

Answer 41 · Mark scheme

2.5	**Level 2:** The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	3–4	AO3/3a 4.6.1.2 RPA8
	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 add or take away masses from the string (ignore any stated values) adjust frequency using the signal generator and/or move the wooden bridge observe a steady / stationary pattern measure the wavelength calculate wave speed from frequency and wavelength a Level 1 answer should include a way of changing tension a complete Level 2 answer would include either changing frequency and/or moving the bridge		
Total		**11**	

4.7.3.2 Uses of the generator effect (HT only)

Answer 42 · Mark scheme

November 2020 | 8463/1H | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	density = $\frac{\text{mass}}{\text{volume}}$ **or** $\rho = \frac{m}{V}$		1	AO1 4.3.1.1
03.2	$998 = \frac{\text{m}}{6\ 500\ 000}$ m = 998 × 6 500 000 m = 6 487 000 000 m = 6.487 × 10^9 (kg)	 allow a correct conversion of their calculated value of mass into standard form	1 1 1 1	AO2 4.3.1.1
03.3	energy transferred = power × time **or** $E = Pt$		1	AO1 4.2.4.2
03.4	t = 18 000 (s) **or** t = 5 × 60 × 60 E = 1.5 × 10^9 × 18 000 E = 2.7 × 10^{13} (J)	 allow a correct substitution using an incorrectly/not converted value of t allow a correct calculation using an incorrectly/not converted value of t	1 1 1	AO2 4.2.4.2
03.5	the variation in demand is (much) greater than 1.5 × 10^9 W demand remains high for longer than 5 hours	allow the increase in demand is greater than the (power) output of the (hydroelectric) power station allow 04:00 to 16:00 is 12 hours allow 04:00 to 16:00 is greater than 5 hours	1 1	AO3 4.1.3
Total			**11**	

4.7.3.2 Uses of the generator effect (HT only)

Answer 43 · Mark scheme

November 2020 | 8463/2H | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	to vary the (output) potential difference so that you don't need a different generator for each type of device	allow different devices require different potential differences allow so that it is compatible with different devices do **not** allow answers in terms of power	1 1	AO3 4.7.3.4
07.2	$\frac{1.5}{5.0} = \frac{150}{N_s}$ $N_s = \frac{150}{0.3}$ $N_s = 500$		1 1 1	AO2 4.7.3.4
07.3	the coil moves through the magnetic field **or** the coil cuts magnetic field lines a potential difference is <u>induced</u> (across the coil) there is a complete circuit, so a current is induced (in the coil) every half turn the potential difference reverses direction so (every half turn) the current changes direction		1 1 1 1 1	AO1 4.7.3.1 4.7.3.2
07.4	provides a continuous / moveable contact / connection (between the coil and the transformer / contacts / brushes) **or** stops the wires from twisting together		1	AO3 4.7.3.2

4.7.3.2 Uses of the generator effect (HT only)

Answer 43 · Mark scheme

07.5	(after disconnection) there is no induced current so no magnetic field (produced around / by the coil) to oppose the movement of the coil		1 1 1	AO1 4.7.3.1
Total			**14**	

4.7.3.2 Uses of the generator effect (HT only)

Answer 44 · Mark scheme

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	E_p = 367 500 000 (J)		1	AO2 4.1.1.2
	367 500 000 = 2 500 000 × 9.8 × h	allow a correct substitution using an incorrectly/not converted value of E_p	1	
	$h = \frac{367\,500\,000}{2\,500\,000 \times 9.8}$	allow a correct rearrangement using an incorrectly/not converted value of E_p	1	
	h = 15 (m)	allow an answer consistent with their value of E_p	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	3 kW = 3000 W		1	AO2 4.1.1.4
	$3000 = \frac{2.16 \times 10^7}{t}$	all subsequent marks can score using an incorrectly / not converted value of P	1	
	$t = \frac{2.16 \times 10^7}{3000}$		1	
	t = 7200 (s)		1	
	$t = 7.2 \times 10^3$ (s)	allow an answer given in standard form from a calculation using data given in the question	1	

4.7.3.2 Uses of the generator effect (HT only)

Answer 44 · Mark scheme

June 2023 | 8463/1H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3		allow reference to specific months eg April to September		AO3 4.1.3
	in the summer the power output from the hydroelectric generator is lower but the solar power output would be greater	allow power output of hydroelectric generator depends on rainfall **and** power output of solar power system depends on light intensity	1	
	so less variation in total power output (which improves the reliability of the supply)	allow electricity supply for total power output	1	

Total Question 4	**11**

4.7.3.2 Uses of the generator effect (HT only)

Answer 45 · Mark scheme

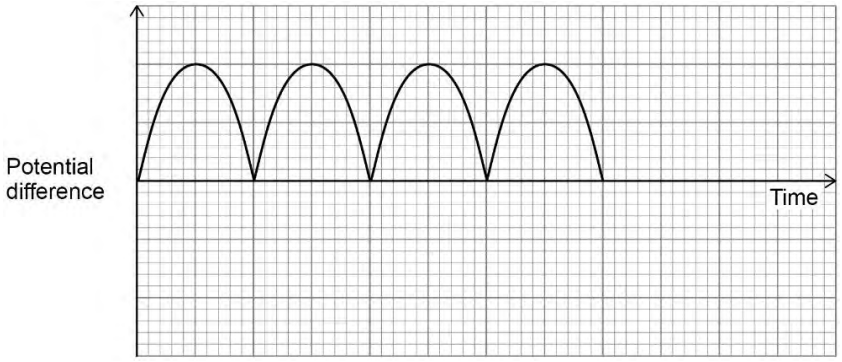
June 2023 | 8463/2H | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	the coil moves through the (magnetic) field **or** the coil cuts (magnetic) field lines		1	AO1 4.7.1.2 4.7.3.1 4.7.3.2
	a potential difference is induced (across the coil)		1	
	there is a complete circuit, so a current is induced (in the coil)		1	
	(because) each half-revolution, the two ends of the coil swap from one brush to the other **or** each half-revolution, (the two halves of) the commutator switch brushes / contacts	(because) the half of the coil connected to each brush always moves in the same direction	1	
	(so) the direction of the (induced) current / potential difference does not reverse every half rotation	allow the direction of the (induced) current / potential difference is the same every half rotation	1	

4.7.3.2 Uses of the generator effect (HT only)

Answer 45 · Mark scheme June 2023 | 8463/2H | Original Q9

Question	Answers	Mark	AO / Spec. Ref.
09.2	 allow a correct graph showing a negative output potential difference only	1	AO1 4.7.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	(after disconnection) there is no (induced) current		1	AO1 4.7.3.1
	(so) no magnetic field (produced around / by the coil)		1	
	to oppose the movement of the coil	allow no force opposes the movement of the coil	1	

Total Question 9	**9**

4.7.3.2 Uses of the generator effect (HT only)

Answer 46 · Mark scheme

June 2024 | 8463/1H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	electrons are transferred to the student		1	AO1 4.2.5.1
	(so) her hair is negatively charged	allow each hair has the same (negative) charge	1	
	(and) like charges repel	do not accept student being positively charged for MP1 and MP2	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	the region (around a charged object) where another charged object experiences a force	allow space / area for region allow particle for object	1	AO1 4.2.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	(electric field strength) decreases		1	AO1 4.2.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	$Q = 2 \times 10^{-6}$ (C)		1	AO2 4.2.4.2
	$0.6 = 2 \times 10^{-6} \times V$	allow a correct substitution of an incorrectly / not converted value of Q	1	
	$V = \frac{0.6}{2\times10^{-6}}$	allow a correct rearrangement of an incorrectly / not converted value of Q	1	
	$V = 300\,000$ (V)	allow an answer consistent with an incorrectly / not converted value of Q	1	

4.7.3.2 Uses of the generator effect (HT only)

Answer 46 · Mark scheme

June 2024 | 8463/1H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	decreased electrical resistance of air		1	AO3 4.2.5.1

Total Question 4	**10**

GCSE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Physics Specification B
3451/F

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

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

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4.7.3.2 Uses of the generator effect (HT only)

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4.7.3.2 Uses of the generator effect (HT only)

GCSE PHYSICS

INFORMATION FOR EXAMINERS

1. General

The mark scheme for each question shows:

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

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

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

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

2. Emboldening

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

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

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

3. Marking points

3.1 Marking of Quality of Written Communication

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

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

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

3.2 Marking of lists

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

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4.7.3.2 Uses of the generator effect (HT only)

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

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

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

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

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

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

3.3 Use of chemical symbols/formulae

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

3.4 The marking of quantitative relationships

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

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

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

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

3.5 Marking procedure for calculations

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

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

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

3.6 Interpretation of 'it'

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

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4.7.3.2 Uses of the generator effect (HT only)

3.7 Errors carried forward

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

Examples

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

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

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

3.8 Phonetic spelling

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

3.9 Brackets

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

3.10 Interpretation of marginal points

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

3.11 Unexpected Correct Answers not in the Mark Scheme

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

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4.7.3.2 Uses of the generator effect (HT only)

GCSE Physics
Foundation Tier 3451/F

3451F Q1

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

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4.7.3.2 Uses of the generator effect (HT only)

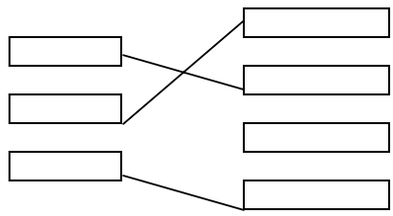
3451F Q2

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

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4.7.3.2 Uses of the generator effect (HT only)

3451F Q3

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

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4.7.3.2 Uses of the generator effect (HT only)

3451F Q4

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

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4.7.3.2 Uses of the generator effect (HT only)

3451F Q5

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

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4.7.3.2 Uses of the generator effect (HT only)

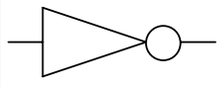
3451F Q6

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

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4.7.3.2 Uses of the generator effect (HT only)

3451F Q7

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

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4.7.3.2 Uses of the generator effect (HT only)

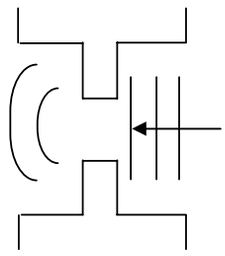
3451F Q8

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

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4.7.3.2 Uses of the generator effect (HT only)

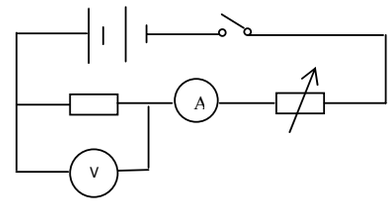
3451F Q9

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

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4.7.3.2 Uses of the generator effect (HT only)

3451F Q10

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

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4.7.3.2 Uses of the generator effect (HT only)

3451F Q11

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

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4.7.3.2 Uses of the generator effect (HT only)

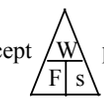
3451F Q12

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

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4.7.3.2 Uses of the generator effect (HT only)

3451F Q13

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

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4.7.3.2 Uses of the generator effect (HT only)

3451F Q14

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

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4.7.3.2 Uses of the generator effect (HT only)

3451F Q15

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

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4.7.3.2 Uses of the generator effect (HT only)

3451F Q16

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

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GCSE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

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

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

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

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4.7.3.2 Uses of the generator effect (HT only)

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4.7.3.2 Uses of the generator effect (HT only)

SCIENCE: DOUBLE AWARD CO-ORDINATED

INFORMATION FOR EXAMINERS

1. General

The mark scheme for each question shows:

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

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

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

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

2. Emboldening

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

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

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

3. Marking points

3.1 Marking of Quality of Written Communication

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

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

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

3.2 Marking of lists

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

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4.7.3.2 Uses of the generator effect (HT only)

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

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

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

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

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

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

3.3 Use of chemical symbols/formulae

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

3.4 The marking of quantitative relationships

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

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

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

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

3.5 Marking procedure for calculations

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

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

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

3.6 Interpretation of 'it'

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

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4.7.3.2 Uses of the generator effect (HT only)

3.7 Errors carried forward

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

Examples

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

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

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

3.8 Phonetic spelling

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

3.9 Brackets

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

3.10 Interpretation of marginal points

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

3.11 Unexpected Correct Answers not in the Mark Scheme

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

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4.7.3.2 Uses of the generator effect (HT only)

Double Award
Foundation Tier 3462/3F

3462/3F Q1

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

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4.7.3.2 Uses of the generator effect (HT only)

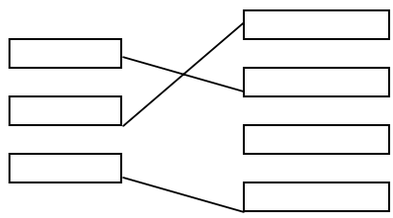
3462/3F Q2

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

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4.7.3.2 Uses of the generator effect (HT only)

3462/3F Q3

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

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4.7.3.2 Uses of the generator effect (HT only)

3462/3F Q4

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

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4.7.3.2 Uses of the generator effect (HT only)

3462/3F Q5

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

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4.7.3.2 Uses of the generator effect (HT only)

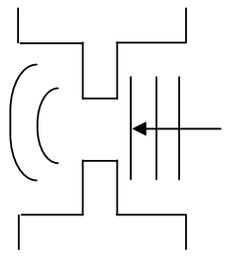
3462/3F Q6

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

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4.7.3.2 Uses of the generator effect (HT only)

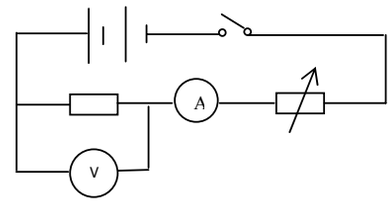
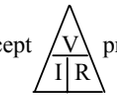
3462/3F Q7

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

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4.7.3.2 Uses of the generator effect (HT only)

3462/3F Q8

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

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4.7.3.2 Uses of the generator effect (HT only)

3462/3F Q9

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

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4.7.3.2 Uses of the generator effect (HT only)

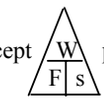
3462/3F Q10

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

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4.7.3.2 Uses of the generator effect (HT only)

3462/3F Q11

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

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4.7.3.2 Uses of the generator effect (HT only)

3462/3F Q12

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

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4.7.3.2 Uses of the generator effect (HT only)

AQA

GCSE

Science A / Physics

PH1HP

Mark scheme

4405/4403
June 2016

Version 1.0: Final Mark Scheme

4.7.3.2 Uses of the generator effect (HT only)

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.

Further copies of this mark scheme are available from aqa.org.uk

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4.7.3.2 Uses of the generator effect (HT only)

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

3.2 Use of chemical symbols / formulae

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

3.3 Marking procedure for calculations

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

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

3.4 Interpretation of 'it'

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

3.5 Errors carried forward

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

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

3.6 Phonetic spelling

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

3.7 Brackets

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

3.8 Accept / allow

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

3.9 Ignore / Insufficient / Do not allow

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

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

4. Quality of Communication and levels marking

In Question **2(b)** students are required to produce extended written material in English, and will be assessed on the quality of their communication as well as the standard of the scientific response.

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

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

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

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

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

4.7.3.2 Uses of the generator effect (HT only)

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

4.7.3.2 Uses of the generator effect (HT only)

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

Question 2 continues on the next page . . .

4.7.3.2 Uses of the generator effect (HT only)

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

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

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

Total			7

4.7.3.2 Uses of the generator effect (HT only)

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1HP– JUNE 2016

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

4.7.3.2 Uses of the generator effect (HT only)

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)(i)	**use of infrared:** remote controls fibre optic (communications) **use of microwaves:** mobile/cell phones satellite (communications/TV) wi-fi Bluetooth	 accept mobiles accept phone signals	1 1	AO1 1.5.1k
4(a)(ii)	any **two** from • same speed **or** travel at the speed of light (in a vacuum) • transverse • transfer energy (from one place to another) • can be reflected • can be refracted • can be diffracted • can be absorbed / transmitted • can travel through a vacuum/space • can be polarised	 accept a full description of a transverse wave travels in straight lines is insufficient	2	AO1 1.5.1c 1.5.1d 1.5.1e 1.5.1g
4(b)(i)	Cosmic Microwave Background (Radiation)	accept CMBR	1	AO1 1.5.4d
4(b)(ii)	 the Big Bang (theory) predicted the existence of CMBR **or** only the Big Bang (theory) supports the existence of CMBR	allow microwave radiation for CMBR throughout allow it supports / proves the Big Bang (theory) accept CMBR disproved other theories, eg steady state	 1	AO1 1.5.4e
Total			**6**	

4.7.3.2 Uses of the generator effect (HT only)

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1HP– JUNE 2016

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	no particles (in a vacuum) (so) no / reduced conduction and no / reduced convection	 both energy transfer methods needed for the mark	1 1	AO1 1.1.3a
5(b)(i)	78 (°C)	allow **2** marks for correct temperature change ie 22 ˚C allow **1** mark for correct substitution ie 46 200 = 0.5 x 4200 x θ **or** $\frac{46200}{0.5\times4200}=\theta$	3	AO2 1.1.4d
5(b)(ii)	6.4 (W)	allow **2** marks for an answer that rounds to 6.4 allow **1** mark for correct substitution ie 46 200 = P x 7200 an answer of 23 000 or 23 100 or 385 gains 1 mark	2	AO2 1.3.1c
Total			**7**	

4.7.3.2 Uses of the generator effect (HT only)

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)	any **two** from: • cost per kWh is lower (than all other energy resources) • infrastructure for nuclear power already exists • more reliable (than renewable energy resources)	allow it is cheaper ignore fuel cost ignore energy released per kg of nuclear fuel accept cost of setting up renewable energy resources is high accept many renewable power stations would be needed to replace one nuclear power station accept (France in 2011 already had a) surplus of nuclear energy, so less need to develop more renewable capacity for increased demand in the future accept France benefits economically from selling electricity accept (nuclear) fuel is readily available ignore destruction of habitats for renewables	2	AO1 AO2 1.4
6(b)	any **two** from: • non-renewable • high decommissioning costs • produces radioactive / nuclear waste • long start-up time • nuclear accidents have widespread implications	allow nuclear fuel is running out accept high commissioning costs allow waste has a long half-life allow for nuclear accident a named nuclear accident eg Fukushima, Chernobyl ignore visual pollution	2	AO1 1.4.1f

Question 6 continues on the next page . . .

4.7.3.2 Uses of the generator effect (HT only)

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1HP– JUNE 2016

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(c)	0.48 (kW)	allow **1** mark for correct substitution ie 0.15 = P / 3.2 an answer of 480 W gains **2** marks an answer of 48 or 480 scores **1** mark	2	AO2 1.2.1d
6(d)	the higher the efficiency, the higher the cost (per m^2 to manufacture)	accept a specific numerical example	1	AO2 AO3 1.4.1c
	more electricity could be generated for the same (manufacturing) cost using lower efficiency solar panels **or** (reducing the cost) allows more solar panels to be bought	accept a specific numerical example	1	
Total			**8**	

4.7.3.2 Uses of the generator effect (HT only)

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1HP– JUNE 2016

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)	surface area **or** duration of experiment	accept shape of beaker size of beaker is insufficient	1	AO3 1.1.3b
7(b)	any **two** from: • takes readings automatically • takes readings more frequently • reduces / no instrument reading error • higher resolution • don't need to remove probe to take reading • more accurate	ignore easier **or** takes readings for you ignore human error allow better resolution	2	AO3 1.1.3
7(c)(i)	0.07 (°C/s)	allow **1** mark for obtaining a temperature drop of 7(ºC) allow **1** mark for an answer between 0.068 and 0.069 (°C/s)	2	AO2 1.1.3d
7(c)(ii)	rate of temperature change is greater at the start **or** rate of temperature change decreases	accept rate of evaporation is greater at the start allow rate of evaporation decreases allow temperature decreases faster at the start	1	AO3 1.1.3b

Question 7 continues on the next page . . .

4.7.3.2 Uses of the generator effect (HT only)

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1HP– JUNE 2016

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(c)(iii)	A lower temperature decrease (over 200 seconds)	reason only scores if A is chosen accept lower gradient	 1	AO3 1.1.3b
7(c)(iv)	no effect (as rate of evaporation is unchanged)	allow larger temperature change (per second as mass of liquid is lower)	1	AO3 1.1.3b
7(d)	particles with more energy leave the (surface of the) liquid (which) reduces the average (kinetic) energy (of the remaining particles)	accept particles with higher speeds allow reference to the total energy of the liquid reducing	1 1 1	AO1 1.1.3b
Total			11	

4.7.3.2 Uses of the generator effect (HT only)

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(a)	any **two** factors: • surface area (of mug in contact with cup warmer) • thickness of mug • temperature of heater / coffee • power of the heater	 accept temperature difference (between heater and coffee) accept power of the laptop ignore efficiency of the heater	2	AO3 1.1.3c
8(b)	atoms (gain kinetic energy and) vibrate faster / more energy is passed on from atom to atom by collision	allow particles / molecules for atoms allow bigger / faster vibrations do not accept start to vibrate accept vibrations for energy an answer in terms of free electrons scores zero	1 1	AO1 1.1.3a
8(c)	the particles spread out (so) coffee becomes less dense (so) the heated coffee rises (and) cooler / denser coffee falls	allow fluid / liquid / water for coffee throughout answer allow particles move further apart allow (coffee) expands particles rise is insufficient particles fall is insufficient	1 1 1 1	AO1 1.1.3a
Total			8	

4.7.3.2 Uses of the generator effect (HT only)

Answer 41 · Examiner comments — June 2019 | 8463/2H | Original Q2

Question 2 (Standard demand)

02.1 Most of the students did suggest using a piece of apparatus that was, recognisably, one that could be thought of as having been designed to measure a length. Many, however, failed to describe it with sufficient clarity to be given the mark. The most common answers that did not gain a mark were 'ruler' and 'metre stick'. A minority of the students opted for pieces of equipment from Figure 4, such as 'signal generator'. Only 57% of the students gave a correct answer.

02.2 Just over 81% of the students knew this equation.

Answer 41 · Examiner comments — June 2019 | 8463/2H | Original Q2

02.3 Some students failed to convert 80 cm to 0.8 m but they were usually able to substitute values into the correct equation and calculate the answer. There were a number of students who used 50 Hz in their calculation despite 55 Hz appearing in the stem of this part question and in Figure 4. There were only a few answers that involved the use of an incorrect value for wavelength.

02.4 Nearly 80% of the students scored at least one mark with half of these scoring both marks. Moving the bridge was a more popular correct answer than changing mass. Some students gave both movement of the bridge and changing the mass but contradicted themselves by, for example, moving the bridge to the right and decreasing mass. References to shortening the string suggested that the students understood what was required but did not describe how to adjust the apparatus to change the length. Similarly, some answers mentioned changing tension but gave no indication of how this could be achieved.

02.5 The majority of the students were able to describe how to vary the tension in the string by changing the masses. Most were able to continue to describe measuring the wavelength and some then described how to calculate wave speed. The aspect that was missing, from all but a few of the answers, was a description of how to obtain a new wave pattern on the string, by moving the bridge or adjusting the frequency.

4.7.3.2 Uses of the generator effect (HT only)

Answer 42 · Examiner comments

November 2020 | 8463/1H | Original Q3

Question 3 (Standard demand)

03.1 91% of students answered this question correctly. The equation was acceptable using symbols or words. Students should be encouraged not to give multiple answers due to the list principle being applied: right + wrong = 0 marks. eg ρ = m/V and m = ρ /V would score zero.

03.2 78% of students scored 4 marks. Most students who knew the equation were able to perform the calculation correctly. A significant number made transcription errors, eg putting the density as 988 kg / m^3 instead of 998 or adding / subtracting a 0 to the given volume. The majority of students were able to express their answer in standard form, even if their calculation was incorrect,.

03.3 85% of students answered this question correctly. The equation was acceptable using symbols or words. Students should be encouraged not to give multiple answers due to the list principle being applied: right + wrong = 0 marks. eg E = Pt and P = t/E would score zero.

03.4 59% of students scored 3 marks. Some students struggled to convert 5 hours into seconds, converting it into minutes instead. A correct calculation using minutes instead of seconds would score 2 marks.

03.5 Only 4% of students scored 2 marks, while 43% of students scored 1 mark. Many students failed to realise that they needed to take data from the graph and compare it with the stated output from the hydroelectric power station. Instead, they gave explanations in terms of people using more energy during the day and / or weather conditions affecting the supply of water. In many cases, despite the diagram showing the power station with a brief explanation of how it works, students referred to unreliable waves and wind, or varying tides. Of the students who took information from the graph, the most common answer was comparing the times involved. Although some students compared the peak demand with the power station output, not many referred to the increase in the demand, which was the relevant point.

4.7.3.2 Uses of the generator effect (HT only)

Answer 43 · Examiner comments

November 2020 | 8463/2H | Original Q7

Question 7 (Standard/high and high demand)

07.1 Many of the students scored one mark for the idea of being able to provide a variable potential difference. A significant number of the students thought incorrectly that it would be the power output that is varied.

07.2 55% of students scored zero, often due to incorrect substitution into the chosen equation.

07.3 This was very poorly answered with very few of the students showing any knowledge of how an alternator works. The vast majority of the students started the explanation by stating that a current flows through the coil, going on to explain with varying degrees of clarity how an electric motor works. A number of the students simply described an alternating current.

07.4 There were many vague answers with only 9% of the students realising the function of the slip rings.

4.7.3.2 Uses of the generator effect (HT only)

Answer 43 · Examiner comments

November 2020 | 8463/2H | Original Q7

07.5 Very few of the students appeared to understand the question asked. A minority gained one mark for stating that there would be no current. A significant number of the students wrote that the current would be reduced. A statement referring to 'magnetic field' was made by a number of students but usually it was not clear which magnetic field was being referred to - that of the permanent magnets or that produced around the coil.

Concluding Remarks

Students appeared to have enough time to answer this paper and the majority had taken the time to learn the required equations.

4.7.3.2 Uses of the generator effect (HT only)

Answer 43 · Examiner comments

Mark Ranges and Award of Grades

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

4.7.3.2 Uses of the generator effect (HT only)

Answer 44 · Examiner comments — June 2023 | 8463/1H | Original Q4

Question 4 (Standard/high Demand)

04.1 In this exam series students were provided with all the equations on an Equations Sheet. 57% of students scored 4 marks, while 32 % of students scored 3 marks, usually for incorrectly or not converting the gravitational potential energy. Changing the mass to grams was counted as a Physics error on Higher Tier questions so scored zero for subsequent calculations. A student could still score the mark for the unit conversion of E_p, however.

04.2 In this exam series students were provided with all the equations on an Equations Sheet. 67% of students scored 5 marks, while 18 % of students scored 4 marks, for either not converting or incorrectly converting the power, or failing to put their answer in standard form. The standard form mark scored independently as long as the student had given a calculated value using data from the question in standard form.

04.3 6% of students scored 2 marks, while 33% of students scored 1 mark. Many students did not use technical vocabulary to express themselves, giving responses which were insufficient. Students needed to make comparison statements about both solar power and

Answer 44 · Examiner comments — June 2023 | 8463/1H | Original Q4

hydroelectric, using the graph to score the first marking point. Statements repeating the questions stem ‘meaning the electricity supply is more reliable’ were insufficient to score the second mark.

Answer 45 · Examiner comments — June 2023 | 8463/2H | Original Q9

09.1

The topic of how motors, dynamos, generators and transformers work has always proved a challenging one, with 2% of students gaining 5 marks for this explanation. There were a number of excellent responses showing clear understanding. Many students scored some marks for describing how the coil cuts the field lines, inducing a potential difference and causing current to flow in a complete circuit. ,Only a few could clearly describe the action of the commutator and brushes swapping the connections every half-turn so the current to the lamp is only in one direction. Some students confused the dynamo for a motor or wrote answers that combined elements of both motor and dynamo. 75% of students scored at least one mark.

4.7.3.2 Uses of the generator effect (HT only)

Answer 45 · Examiner comments

June 2023 | 8463/2H | Original Q9

09.2

17% of students could correctly draw four half-cycles to represent the output of two complete turns of the dynamo. Most drew a sine wave or an incorrect number of half-cycles.

09.3

A small number of students were able to write that without a current in the coil, there would be no magnetic field in the coil; fewer were able to state that this would remove the opposing force. Some thought there would still be a current in the coil , or that the current would increase creating an attractive force between the coil and magnets. Some students thought that friction at the brushes or the resistance of the lamp were the factors that had been reduced. 15% of students scored at least one mark on this question, with 3% getting full marks.

Mark Ranges and Award of Grades

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

4.7.3.2 Uses of the generator effect (HT only)

Answer 46 · Examiner comments

June 2024 | 8463/1H | Original Q4

Question 4 (Standard/High Demand)

04.1 Students answers were generally very confused with this question and statements about transfer of positive electrons or protons or even neutrons were commonly seen. Students struggled to understand that when you are in contact with a charged object you have the same charge as that object. It was common to see statements about the dome being negative so the student (and her hair) are positively charged. If a student said that the student was positively charged they could not score mark points 1 and 2, but they could still score mark point 3 if they said that like / same charges repel. 10% of students scored 3 marks, while 15% scored 2 marks and 32% scored 1 mark.

04.2 Only 8% of students scored a mark on this question. An answer of 'the area / space / region where an electron experiences a force' was creditworthy as were other examples of charged particles or ions. 'The area where other charged particles experience repulsion or attraction' was also creditworthy. Neither of these examples were seen often, however.

04.3 92% scored a mark for this question. A surprisingly large number of students made statements like 'as you get closer to the dome, the field strength increases' answering the question in the opposite way to the way it was set out. They scored a mark but would have saved a lot of time by writing 'it decreases.'

04.4 Some students did not convert, or incorrectly converted, the unit of charge and scored 3 marks.. Some students incorrectly converted the unit for charge and also spuriously converted the energy by multiplying or dividing by a power of ten. These students made two mistakes, so scored a maximum of 2 marks on this question. 36% of students scored all 4 marks, while 56% of students scored 3 marks for this calculation of potential difference.

04.5 80% of students identified the factor that would increase the distance a spark can jump between two objects.