GCSE Physics (AQA 8463)

Higher Tier

Mark scheme

Introduction

The information provided for each question is intended to be a guide to the type of answers students may produce, but can be neither exhaustive nor prescriptive. Award marks according to your professional judgement for all appropriate responses.

Disclaimer

- These mark schemes and exemplar answer content are entirely the work of the question author and have not been produced by, reviewed by or endorsed by AQA.
- Where marks are suggested and levels mapped to particular styles or features of answers, these are intended for guidance only and cannot reflect the full examination marking process, which involves moderation and alignment of level boundaries across a full, national student cohort that cannot be determined from a standalone product such as this set of Practice Papers.
- Therefore, mark allocation, mark totals, suggested levels and overall assessments of performance as found in these Practice Papers and Mark Schemes represent only a limited guide to possible outcomes, and are not a reliable indicator of actual performance.

Information for teachers

1. General

The mark scheme for each question gives:

- the marks available for each part of the question
- the total marks available for the question
- the correct answer or, if multiple correct answers are possible, a typical correct answer with variations
- extra information to help with making decisions about how many marks to award
- the Assessment Objective(s) from the GCSE Specification that the part question is intended to cover.

The 'extra information' is aligned to the appropriate answer and is only intended for consideration with that particular part of the answer.

2. Marking of lists

For question parts where a set number of responses is requested, all possible correct answers are stated. Each correct response should be awarded a mark as indicated, up to a maximum for the question part as stated on the question paper and as written in this marks scheme.

If a student has provided more than the set number of responses requested, the principle to be followed is that 'right + wrong = wrong'. Each error or contradictory response negates each correct response. If the number of errors and contradictions equals or exceeds the number of correct responses, no marks can be awarded for that part of the question.

3. Use of symbols and formulae

If an accepted scientific symbol or formula is written instead of a required chemical name or unit, award full marks if the symbol or formula is correct and if, in the context of the question, the response is appropriate.

4. Calculations

Award marks for each correctly completed stage of a calculation, as students are instructed to show their working.

Full marks can be given for a correct numerical answer (including units), even though no working is shown.

5. Interpretation of 'it' and 'them'

Answers using the word 'it' or 'them' should be awarded marks only if it is clear that the 'it' or 'them' refers to the correct subject.

6. Errors carried forward

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

Allowances for errors carried forward are usually restricted to calculation questions. Where such allowances are permissible, the mark scheme includes a statement such as 'allow ecf'.

7. Phonetic spelling

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

8. Brackets

(……) in this marks scheme indicates information that is not essential for a mark to be awarded, but is included to help you identify the sense of the required answer.

9. Ignore / insufficient / do not allow

'Ignore' or 'insufficient' are used in this marks scheme to indicate information that is irrelevant to the question or not enough to gain the mark. Further correct amplification could gain the mark.

'Do not allow' indicates that this is a wrong answer which, even if the correct answer is also given, still means that the mark should not be awarded.

'Level of response' marking instructions

'Level of response' mark schemes are broken down into levels, each of which is given a descriptor. The descriptor for a level shows the average performance for that level. There are marks allocated to each level.

Before applying the mark scheme to a student's answer, read through the answer and annotate it to show the qualities that are being looked for. Then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a 'ladder' to see whether the answer meets the qualities given in the descriptor for that level. If the answer meets the lowest level, move up to the next level and repeat the assessment until you find a match between the descriptors and the answer.

When assigning a level, you should look at the overall quality of the answer and not be distracted by small details of the answer where the student may not have performed quite as well as their overall performance. If an answer covers different aspects of different levels of the mark scheme, use a 'best fit' approach: for example, if a response is predominantly level 2 with a small amount of level 3 material, place it in level 2 but award a mark near the top of the level because of the level 3 content.

Step 2 Determine a mark

The descriptors within each level can help with this, along with the exemplar answers or extra information given. Indicative content is provided as a guide. It is not exhaustive and you should credit other valid points in the answer. Students do not have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

Ignore any responses that are irrelevant. However, only award full marks if there are no incorrect or contradictory responses.

An answer that contains nothing of relevance to the question must be awarded no marks.

Read back through the full answer as you apply the mark scheme, so as to clarify points and assure yourself that the level and the mark are appropriate.

Paper 1

Question 1

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
01.1	**Level 3:** detailed method with details of sources of errors and how to minimise them		5	AO3 WS2.2, 4.3.1.1
	Level 2: detailed method with some omissions (e.g. no discussion potential sources of error)		3–4	
	Level 1: some relevant points made to outline a simple procedure		1–2	
	No relevant content		0	
	Indicative content Setting scale to zero before measuring mass of rods. Measuring diameter of rods in at least two different points and calculating a mean. Use ruler to measure length of rod. Calculate volume of rod. Discuss potential difficulties accurate readings, e.g. rods may be slightly bent, etc.			
01.2	Correct use of standard form Density = 0.1788 / 0.000 02 = 8940		1 1 1	AO2 WS4.4 4.3.1.1
01.3	5.24 mm		1	AO1 WS2.6
TOTAL			**9**	

Question 2

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
02.1	$\Delta E = mc\Delta\theta$ or word equation $-\Delta\theta = 36.7 - 21.4 = 15.3°$ $\Delta E = 0.000\,61 \times 140 \times 15.3$ $= 1.3$ J		1 1 1 1	AO2 4.1.1.3 4.3.2.2
02.2	• As the thermometer is in contact with the body, there is a temperature difference between the body and the mercury in the thermometer • This causes an energy transfer between the body and the mercury • The atoms of mercury begin to move faster • The mercury expands and climbs along the capillary tube in the thermometer		1 1 1 1	AO2/1 4.3.3.1
TOTAL			**8**	

Question 3

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
03.1	protons neutrons		1 1	AO1 4.4.1.1
03.2	4		1	AO1 4.4.1.1
03.3	Tick in the box with the third option: (✓) Atoms that have different mass number, but the same atomic number		1	AO1 4.4.1.2
03.4	7 protons 7 electrons 16 – 7 = 9 neutrons		1 1 1	AO1 4.4.1.2
TOTAL			**7**	

Question 4

04.1	Tick in the box with the second option: (✓) A nucleus of helium (two protons and two neutrons)		1	AO1 4.4.2.1
04.2	Tick in the box with the third option: (✓) Beta particles or gamma rays		1	AO1 4.4.2.1
04.3	Tick in the box with the last option: (✓) Any of these is possible		1	AO1 4.4.2.3
04.4	$^{90}_{38}Sr \rightarrow {}^{90}_{39}Y + {}^{0}_{-1}e$		2	AO2 4.4.2.2
TOTAL			**5**	

Question 5

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
05.1	**Level 3:** detailed description of chain reaction and function of control rods, including absorption of neutrons to reduce rate of emitted neutrons causing fissions, or ratio 1:1		5–6	AO2 4.4.4.1
	Level 2: detailed description of chain reaction and some understanding of control rods shown.		3–4	
	Level 1: Simple description of chain reaction, or control rods.		1–2	
	No relevant content.		0	
	Indicative content • Neutron absorbed by nucleus of nuclear fuel (uranium/ plutonium). • Nucleus splits into two smaller nuclei releasing energy and 2–3 further neutrons. • Fission neutrons can fission other nuclei and the reaction progresses into a chain reaction. • Control rods are made of cadmium or boron. • They can absorb neutrons without undergoing fission. • Rods are inserted in the reactor core deep enough to cause one further fission for each nucleus that splits/ to control the reaction.			
05.2	Advantage: • Very high power output Disadvantage: • Nuclear waste difficult to store safely • Large decommissioning costs • Risks of nuclear disasters, e.g. Fukushima/Chernobyl		1 1	AO1 4.1.3 4.4.2.4
05.3	Tick in the box with the third option: (✓) Nuclear fusion is the merging of two light nuclei to form a heavier nucleus. The mass of the product nucleus is smaller than the combined mass of the two lighter nuclei.		1	AO1 4.4.4.2
TOTAL			**9**	

Question 6

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
06.1	When the spring is fully compressed the elastic potential energy store **is full**. When the toy has reached its highest point the **gravitational potential** energy store is full and the **elastic potential** energy store has emptied. Some of the initial energy has increased the **thermal** energy store associated with the surroundings.		4	AO1 4.1.1.1
06.2	Convert 3 cm to 0.030 m Use $E_e = \frac{1}{2} ke^2$ $= \frac{1}{2} 70 \times 0.030^2$ = 0.0315 J		1 1 1 1	AO2 4.1.1.2
06.3	Convert 6 g to 0.006 kg Use $E_p = mgh$ = 0.006 × 9.8 × 0.48 = 0.0282 J		1 1 1 1	AO2 4.1.1.2
06.4	Efficiency = 0.0282 / 0.0315 = 0.90 (or 90%)	Allow ECF	2	AO2 4.1.2.2
TOTAL			**14**	

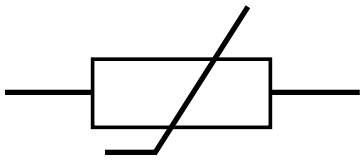
Question 7

07.1	correct labelled scales correct plots curve of best fit	Remove 1 mark for each incorrect plot	1 2 1	AO2 WS3.1, WS3.3 4.4.2.1 4.4.2.3
07.2	Tick in the box with the first option: (✓) The time it takes for the number of nuclei of the isotopes in a sample to halve		1	AO1 4.4.2.3
07.3	Accept 7 or 8 years	Accept correct reading from own graphs with incorrect plots	1	AO2 WS3.2 4.4.2.3
07.4	Results will be more accurate … because the sample of data has increased … and the curve will become smoother		1 1 1	AO3 WS3.3, WS3.5 4.4.2.3
TOTAL			**9**	

Question 8

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
08.1	Tidal Wave power		1 1	AO1 4.1.3
08.2	Renewable energy resources can be replenished Non-renewable energy resources will run out when their reserve has been used up		1 1	AO1 4.1.3
08.3	Advantages: • Natural gases are less polluting than oil or coal • Easy to transport • Not dependent on weather conditions Disadvantages: • Release greenhouse gases • Non-renewable		2 2	AO1 4.1.3
TOTAL			**8**	

Question 9

09.1			1	AO1 4.2.1.1
09.2	10.5 to 36 kΩ	Accept 10 kΩ	2	AO1 WS3.5 4.2.1.4
09.3	38 °C generates a resistance of 6 kΩ in the thermistor Rearrange to $I = V/R$ $I = 3 / 6000$ $= 0.0005$ A $= 0.5$ mA		1 1 1 1	AO2 4.2.1.3
09.4	50–70 °C	Accept 46–70	1	AO2 WS3.5 4.2.1.4
TOTAL			**8**	

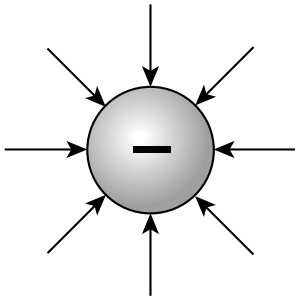
Question 10

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
10.1	Convert 63 mA to 0.063 A $R_1 + R_2 = 230 + 45 = 275\ \Omega$ $I_1 = V / (R_1 + R_2) = 6 / 275 = 0.022$ A $I_2 = 0.063 \leftrightarrow 0.022 = 0.041$ A $R_3 = V / I_2 = 146\ \Omega$		1 1 1 1 1	AO3 4.2.1.3 4.2.2
TOTAL			**5**	

Question 11

11.1	$E_p = 5.5 \times 9.8 \times 52$ $= 2803$ J		1 1	AO2 4.1.1.2
11.2	$E_p = E_k = \frac{1}{2} mv^2$ $2803 = \frac{1}{2}\ 5.5 \times v^2$ $v = \sqrt{\frac{2 \times 2803}{5.5}}$ $= 32$ m/s		1 1 1 1	AO3 4.1.1.2
11.3	No energy was wasted due to air resistance		1	AO3 4.1.2.1
TOTAL			**7**	

Question 12

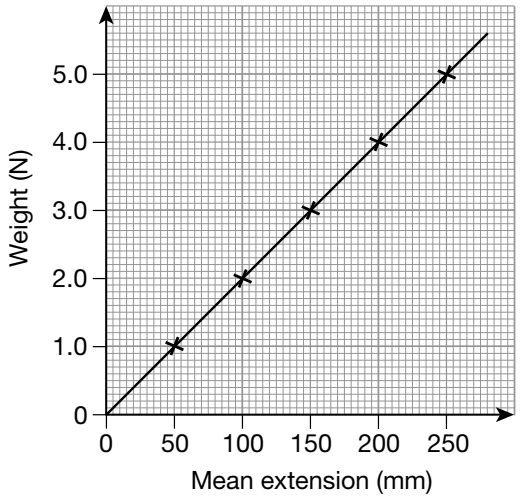
QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
12.1	Gurinder's jumper rubbed against the seat of his car. Electrons transferred from the fabric of the seat to the jumper (or the other way round). When Jake's hand approaches the metal door a large potential difference is generated between the hand and the door. The p.d. is large enough to cause a spark to jump from Jake's hand to the metal door.		1 1 1 1	AO2 4.2.5.1
12.2	 1 mark for radial field 1 mark for correct direction		2	AO1 4.2.5.2
TOTAL			**6**	

Question 13

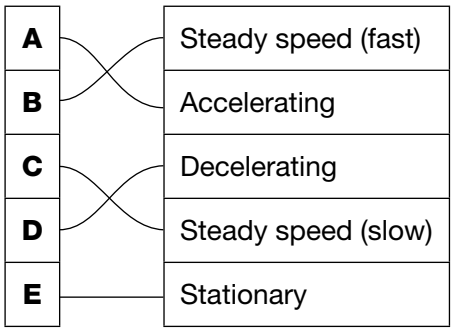
13.1	Arrows of different size on each ball and different direction on each ball		1 1	AO1 4.3.3.1
13.2	Random direction and random speed		1 1	AO1 4.3.3.1
13.3	Tick box against first option: (✓) The total kinetic energy and potential energy of all the particles of gas		1	AO1 4.3.2.1
TOTAL			**5**	

Paper 2

Question 1

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
01.1	correct means accept 49 | 100 | 150 | 200 | 250 or 49 | 99.5 | 150 | 199.5 | 249.5 correct sig figs	If 2nd row is given only 1 mark max can be awarded. Penalise any incorrect rounding. Whole numbers only. Answers must all be as in the first row.	1 1	AO2 4.5.3 8.2.6 MS 2 b&f AO2 MS 2a
01.2	Suitable *x*- and *y*-axis scale  Correctly plotted points +/– 1 small square deduct 1 mark for each error. (Straight line of best fit that goes through the origin.)	Must use more than 50% of each axis. It must be drawn with a ruler	1 3 1	AO2 4.5.3 8.2.6 MS4a&c AO2 AO3
01.3	It is linear, or Mean extension is (directly) proportional to weight.	 (or the other way round)	1	AO3 4.5.3 8.2.6
01.4	Suitable reference lines drawn on the graph. $k = \frac{F}{e} = \frac{5.0}{250} = 0.02$ N/mm		1 1	AO3 4.5.3 8.2.6 MS4.a AO2
TOTAL			**10**	

Question 2

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
02.1		1 mark for each correct response	5	AO1 4.5.6.1.4
02.2	45 m	Unit not required	1	AO3 4.5.6.1.4
02.3	$\frac{15}{2.5} = 6$ m/s	If 15 m seen and answer incorrect 1 mark only. or If 2.5 s seen and answer incorrect award 1 mark only. (both may not apply separately)	2 1	AO3 4.5.6.1.2 4.5.6.1.4 7.4.a&d AO1 4.5.6.1.2 4.5.6.1.4 7.4.a&d
TOTAL			**9**	

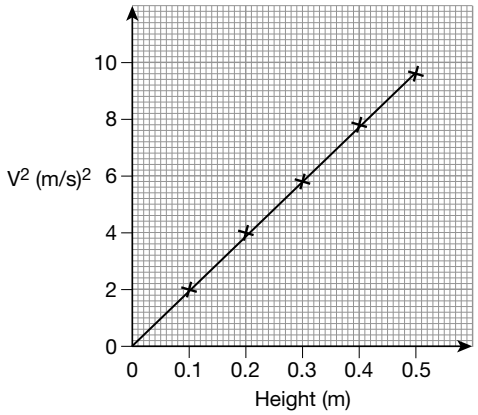
Question 3

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
03.1	$f = \frac{v}{\lambda} = \frac{3.0 \times 10^8}{100}$	Correct rearrangement or correct substitution required	1	AO2 4.6.1.2 MS 1c,3b,c
	$= 3.0 \times 10^6$	Accept in standard form or as 3 000 000 Or 3.0 M	1	AO2
	Hz	Penalise incorrect use of capitals or lowercase.	1	AO1
TOTAL			**3**	

Question 4

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
04.1	small region receding		1 1	AO1 4.8.2
04.2	**Level 3:** A detailed and coherent explanation is provided. The student gives examples that argue a strong case and demonstrate deep knowledge. The student makes logical links between clearly identified, relevant points.		5–6	2 × AO2/2 4.8.2
	Level 2: An attempt to link the description of the experiment and the results with differences between the two models. The student gives examples of how red shift observation can support the big bang theory. The logic used may not be clear.		3–4	1 × AO1/1 1 × AO2/2
	Level 1: Simple statements are made that the big bang can be explained by red shift observations. The response may fail to make logical links between the points raised.		1–2	2 × AO1/1
	No relevant content		0	
	Indicative content • Red shift is where spectral lines/absorption/ emission lines move to the red end of the spectrum. • All distant galaxies show a red shift. • Greater red shift means the distant galaxy or star has a greater recessional speed/ is moving away faster. • More distant galaxies show greater red shift than nearer ones … • … this would suggest that more distant galaxies are moving away faster than closer ones. • … this would suggest that most galaxies are moving away from each other and the Universe is expanding. • If time is reversed/or we extrapolate backwards, then the Universe started from an initial point. • Where all matter was concentrated in one tiny point. • At some point in the past the tiny point had an explosion/ underwent a period of very rapid expansion. This is called the Big Bang.			
TOTAL			**8**	

Question 5

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
05.1	<table><tr><th>Velocity² v^2 (m/s)²</th><th>Velocity² v^2 (m/s)²</th></tr><tr><td>2.0</td><td>1.96</td></tr><tr><td>4.0</td><td>4.0</td></tr><tr><td>5.8</td><td>5.76</td></tr><tr><td>7.8</td><td>7.84</td></tr><tr><td>9.6</td><td>9.61</td></tr></table>	1st mark awarded for correctly calculated (velocity)² value. 2nd mark awarded for correct significant figures as per first column. 1 mark max for (velocity)² as per second column. Zero marks if any answers contain rounding errors.	1 1	AO2 MS2.b&f WS 4.6
05.2	Correctly plotted points Suitable line of best fit drawn. 	Penalise any point out by more than +/– 1 small square. Straight line drawn with a ruler through the origin.	2 1	AO2 MS 4 a–c AO3
05.3	Suitable reference lines drawn Gradient is 20 m/s²	Unit not required Accept value in the range 19–21.	1 1	AO2 MS 4.b

Question 5

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
05.4	$v^2 = 2as$ and linking to $y = mx + c$ Gradient = $\frac{20}{2} = 10$ m/s^2	Or accept gradient = $2a$ Award mark for answer with no workings accept value from question part 5.3 divided by 2. Unit required	1 1 1	AO2 MS 4.b AO2 AO1
05.5	Any **two** from: Repeat readings but could alternatively comment that repeats aren't necessary as there are no significant anomalies. Use a magnetic switch to drop the ball to ensure that initial speed is zero. Take readings over a larger range of heights. Take more than 5 readings. Take a range of readings with smaller intervals.	1 mark per correct response	2	AO3 WS 2.7
TOTAL			**12**	

Question 6

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
06.1	**Level 3:** A detailed and coherent explanation is provided. The student gives examples that demonstrate deep knowledge. The student makes logical links between clearly identified, relevant points.		5–6	4.8.1.2 2 × AO2/2
	Level 2: An explanation is provided that has elements that are detailed and coherent but that do not always demonstrate deep knowledge. The logic used may not be clear at all times.		3–4	1 × AO1/1 1 × AO2/2
	Level 1: Simple statements are made but the response may fail to make logical links between the points raised.		1–2	2 × AO1/
	No relevant content		0	
	Indicative content • A cloud of dust and gas called a nebula … • … is pulled together by gravity. • Temperature increases and this stage is called a protostar. • Temperature and pressure are not high enough for fusion to take place. • At very high temperature and pressure fusion takes place. • Fusion releases energy. • Outward radiation pressure balances inward gravitational pressure this stage is called a main sequence star. • Main sequence star lasts for billions of years. • Once hydrogen has been used up star expands to a red giant. • Then it contracts to a (dense) white dwarf.			
06.2	(Instead of forming a red giant) it would form a red super giant. Instead of forming a white dwarf there would be supernova explosion. Then (depending on mass) it would go on to form either a neutron star or a black hole.		1 1 1	AO3 4.8.1.2
TOTAL			**9**	

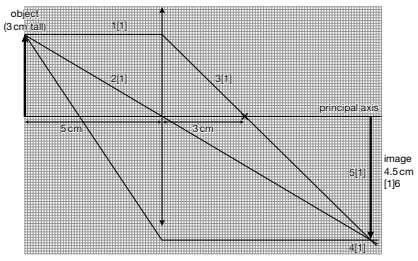
Question 7

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
07.1	$p_a = m_a \times v_a = 900 \times 18$ $= 16\,200$ kg m/s $p_b = m_b \times v_b = 700 \times -10$ $= -7000$ kg m/s	Right has been considered as positive displacement. Accept opposite provided rest of answer is consistent. If numbers 16 200 and 7000 are seen award first two marks.	1 1	AO1 WS 1.2 MS 3b, c 4.5.7.1 4.5.7.2
	$p_{total} = p_a + p_b = 16\,200 - 7000$ $= 9200$ kg m/s	Award 3 marks for correct calculation of 9200 even if working is not clear. Accept N s	1 1	AO1 AO1
07.2	$\text{mass}_{\text{total}} = \text{mass}_{\text{a}} + \text{mass}_{\text{b}}$ $= 900 + 700 = 1600$ kg	Award mark if 1600 is seen	1	AO2 WS 1.2 MS 3b, c 4.5.7.1
	$v_{a+b} = \frac{p_a + p_b}{m_{a+b}} = \frac{9200}{1600}$	Award 1 mark for stating that momentum before = momentum after if other marks not awarded.	1	AO2 4.5.7.2
	5.8 m/s	Accept 6 m/s and do not penalise significant figures.	1	AO2
07.3	Force experienced is proportional to the rate of change of momentum.	Accept correct use of the equation $F = \frac{m\Delta v}{\Delta t}$	1	AO1 4.5.7.3 MS 3b.c WS 1.2,4
	Air bags and crumple zones Increase the collision time in an accident. This reduces the force to a (safer) level that does not cause serious injury.	Do not award any marks for response that refer to cushioning the impact or absorbing forces.	1 1	AO3
TOTAL			**10**	

Question 8

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
08.1	The motor effect		1	AO1 4.7.2.2
08.2	a) motion or force	Accept thrust	1	AO1 4.7.2.2
	b) current (conventional)		1	
	c) field direction (N to S)		1	
08.3	$F = BIL$	Stated in words or symbols.	1	AO2 4.7.2.3 MS 3b, c
	40 cm = 0.4 m	Correct conversion of cm to m. Award mark if seen in next stage.	1	
	$B = \frac{F}{IL} = \frac{0.3}{5 \times 0.4} = 0.15$	Correct substitution	1	AO1
	0.15 T or tesla	Unit required	1	
TOTAL			**8**	

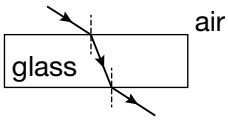
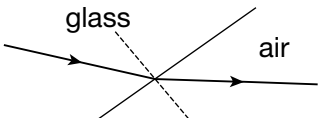
Question 9

09.1	horizontal line from object to lens	Allow the construction lines through focal point on object side and parallel line to principal axis as alternative to mark points 1 and 2	1	AO3 AO2
	line from top of object through centre of lens to intersection point		1	
	line from top of lens passing through focal point		1	
	intersect of at least two lines		1	
	image drawn with arrow		1	
	4.5 cm	Accept in range 4.25–4.75 cm	1	
				
09.2	1 mark per correct response: real enlarged / magnified inverted		2	AO1
TOTAL			**8**	

Question 10

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
10.1	$P = VI$ so $I = \frac{P}{V}$ $= \frac{5 \times 10^6}{2.3 \times 10^3}$ $= 2.2 \times 10^3$ A or 2.2 kA	Award 2 marks if correct answer stated. Accept any answer that rounds to 2.2 Accept 2200 or number that rounds to 2200	 1 1	AO1 4.2.4.3 4.7.3.4 MS 3b,c AO2
10.2	Increasing voltage causes current to go down. A reduced current causes less power losses in transmission.	Accept reference to $V_s \times I_s = V_p \times I_p$ If explained for first mark. Accept reference to $P = I^2 R$	1 1	AO2 4.2.4.3 4.7.3.4 AO3
10.3	$V_s \times I_s = V_p \times I_p$ $675 \times 10^3 \times I_s = 2.3 \times 10^3 \times 2.2 \times 10^3$ $I_s = \frac{2.3 \times 10^3 \times 2.2 \times 10^3}{675 \times 10^3} = 7.5$ A	Award 2 marks if answer is correct	1 1	4.2.4.3 4.7.3.4 MS 3b,c AO2
TOTAL			**6**	

Question 11

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
11.1	correctly drawn normal ray bending to normal in block ray bending away from normal on leaving block 	 Ray must be roughly parallel to original incident ray.	1 1 1	AO2
11.2	correctly drawn normal ray bending away from normal on entering air 		1 1	AO2
TOTAL			**5**	

Question 6

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
12.1	In a longitudinal wave particles / the wave vibrates parallel to the wave direction / energy transfer. In a transverse wave the particles vibrate perpendicular / at right angles to the wave direction / energy transfer.		1 1	AO1 4.6.1.1
12.2	**Level 3:** A detailed and coherent explanation is provided. The student gives examples that demonstrate deep knowledge. The student makes logical links between clearly identified, relevant points.		5–6	2 × AO2/2 4.8.2
	Level 2: An explanation is provided that has elements that are detailed and coherent but that do not always demonstrate deep knowledge. The logic used may not be clear at all times.		3–4	1 × AO1/1 1 × AO2/2
	Level 1: Simple statements are made but the response may fail to make logical links between the points raised.		1–2	2 × AO1/1
	No relevant content		0	
	Indicative content • The current in the circuit is constantly changing/varies. • The current passes through the coil. • The magnetic field of the coil is changing. • The coil experiences a force of attraction or repulsion from the permanent magnet. • This changes, depending on the current's direction. • This pushes the coil in an out. • The size of the current affects the size of the force. • Larger current causes a greater force (of repulsion or attraction). • The changing current causes the coil to vibrate. • The (vibrating) coil makes the cone vibrate as well. • The vibrations of the cone cause the air molecules to move. • This movement of the air molecules produces the pressure variations in the air needed for a sound wave. • When the air molecules are pushed together this is called a compression. When the air molecules spread out this is called a rarefaction.			
TOTAL			**8**	

Question 13

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
13.1	1 mark for each of the following: • X-rays cause ionisation of atoms/molecules. • Ionisation can lead to cell multiplication that is faster than normal in foetus. • Rapid cell multiplication / X-rays increase risk of mutations. • Mutations can lead to harmful / abnormal growth of foetus.	Penalise use of baby instead of foetus but only penalise for one of the marking points.	4	AO1/1
TOTAL			**4**	

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Authors Alessio Bernardelli, Sam Jordan

Editorial Team Aidan Gill, Turnstone Solutions Limited,
Lynette Woodward

Cover and Series Design Andrea Lewis

Design Oxford Designers & Illustrators Ltd