GCSE Physics (AQA 8463)

Foundation 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 01

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
01.1	Energy that is dissipated in the surroundings		1	AO1 4.1.2.1
01.2	Use lubrication on the gears Remove dirt and dust from the gears		1 1	AO2 4.1.2.1
01.3	is full has emptied elastic potential dissipated	Correct order only	4	AO1 4.1.1.1 4.1.2.1
01.4	$E_p = m\ g\ h$ (or word equation) $E_p = 0.240 \times 9.8 \times 0.57$ = 1.341 J	Quote equation Substitutions Answer	1 1 1	AO2 4.1.1.2 WS 4.3
01.5	Efficiency = 1.341/2.352 = 0.57 Alternative method: Efficiency = 57 m / 1 m = 0.57	Substitution Answer (decimal number must be shown)	1 1	AO3 4.1.2.2
TOTAL			**12**	

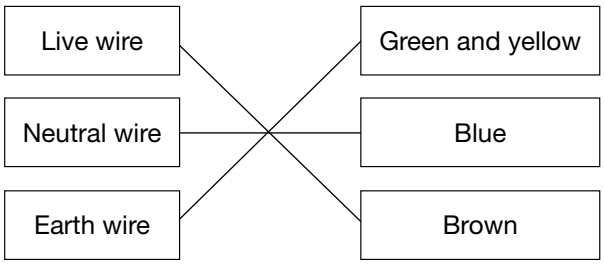
Question 02

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
02.1	Any **two** from: nuclear fuels, bio-fuel, hydroelectricity, geothermal, tides, and water waves.	Do not accept oil, coal or natural gas	2	AO1 4.1.3
02.2	In this order on the answer grid: C B A D	One mark for each correct answer Correct order only	4	AO1 4.1.3
02.3	Solar panels need light from the Sun to work. During the times in A and D it is too dark for the panels to generate electricity. So the power used in A and D needs to be supplied by other energy resources.		1 1 1	AO1 4.1.3 4.1.1.4
02.4	20 000 000 / 3400 = 5882		1 1	AO2 4.1.1.4
02.5	The power output of the solar panels depends on weather conditions.		1	AO2 4.1.3
TOTAL			**12**	

Question 03

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
03.1	Variable resistor		1	AO1 4.2.1.1
03.2	**Level 3:** detailed method with safety considerations and suggestions to improve accuracy		5–6	AO2 4.2.1.4
	Level 2: detailed method with some omissions (e.g. no safety considerations)		3–4	
	Level 1: some relevant points made to outline a simple procedure		1–2	
	No relevant content		0	
	Indicative content • Measure current across the filament lamp • Measure p.d. across the filament lamp • Calculate resistance from *I* and *V* measured • Repeat readings and mean calculation • Safety considerations, e.g. using p.d. lower than lamp's rating • Changing resistance of variable resistor to change the p.d. and current			
03.3	The student should reverse the p.d. And record the p.d. and current for negative values of p.d. by changing the resistance of the variable resistor		1 1	AO2 4.2.1.4
03.4	The temperature of the filament increases as the current through it increases, so it has higher resistance		1	AO3 4.2.1.4
TOTAL			**10**	

Question 04

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
04.1		1 mark for each correct answer up to 2 marks	2	AO1/2 4.2.3.2
04.2	live 230 V neutral 0 V	Correct order only	4	AO1 4.2.3.2
04.3	AC potential difference means that: • the p.d. across the circuit changes in value • and direction		 1 1	AO1 4.2.3.1
04.4	$V = IR$ $I = V/R$ $= 230/10 = 23$ A		1 1 1	AO2 4.2.1.3 WS 4.3
04.5	Use value of I from 4.4 (ECF) $P = 230 \times 23$ $= 5290$ W 5.29 kW	 Accept 5.3 kW	 1 1 1	AO2 4.2.4.1 WS 4.3 WS 4.4
TOTAL			**14**	

Question 05

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
05.1	**Level 3:** detailed method with details of sources of errors and how to minimise them		5	AO3 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.			
05.2	Correct use of standard form Density = 0.1788 / 0.000 02 = 8940 (kg/m^3)		1 1 1	AO2 4.3.1.1 WS 4.3 WS 4.4
05.3	5.24 mm		1	AO1 4.3.1.1
TOTAL			**9**	

Question 06

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
06.1	$\Delta E = mc\Delta\theta$ 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 4.3.2.2 WS 4.3
06.2	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	AO3 4.3.3.1
TOTAL			**8**	

Question 07

07.1	Protons Neutrons		1 1	AO1 4.4.1.1
07.2	4		1	AO1 4.4.1.1
07.3	Atoms that have different mass number, but the same atomic number		1	AO1 4.4.1.2
07.4	7 protons 7 electrons 16 – 7 = 9 neutrons		1 1 1	AO1 4.4.1.2
TOTAL			**7**	

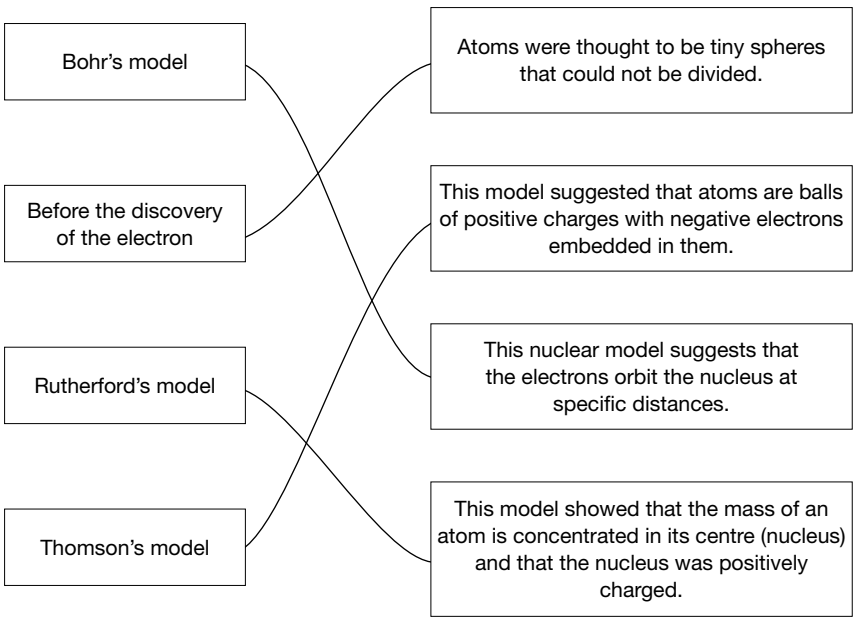
Question 08

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
08.1	Non-contact force	Accept electrostatic force	1	AO1 4.2.5.2
08.2	Negative charges are rubbed off one material and on to the other		1	AO1 4.2.5.1
08.3			2	AO1 4.2.5.2
TOTAL			**4**	

Question 09

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
09.1	The relationship Harry is investigating is valid only when the temperature remains constant So, waiting 30 s allows the temperature of the gas to go back to room temperature And the results will be more accurate and valid		1 1 1	AO3 4.3.3.2
09.2	pV = constant p = 129 950 × 0.0010 / 0.0005 = 259 900 Pa	Or any other pV from the table of results. 1 mark for substitution and 1 mark for correct pV choice	1 2 1	AO3 4.3.3.2
09.3	Correct scales drawn and labelled Correct plots drawn Suitable line of best fit		1 2 1	AO2 4.3.3.2
TOTAL			**11**	

Question 10

10.1			3	AO2 4.4.1.3
TOTAL			**3**	

Question 11

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
11.1	A nucleus of helium (two protons and two neutrons)		1	AO1 4.4.2.1
11.2	Beta particles or gamma rays		1	AO2 4.4.2.1
11.3	Any of these is possible		1	AO2 4.4.2.3
11.4	$^{90}_{38}Sr \rightarrow {}^{90}_{39}Y + {}^{0}_{-1}e$		2	AO2 4.4.2.2
TOTAL			**5**	

Question 12

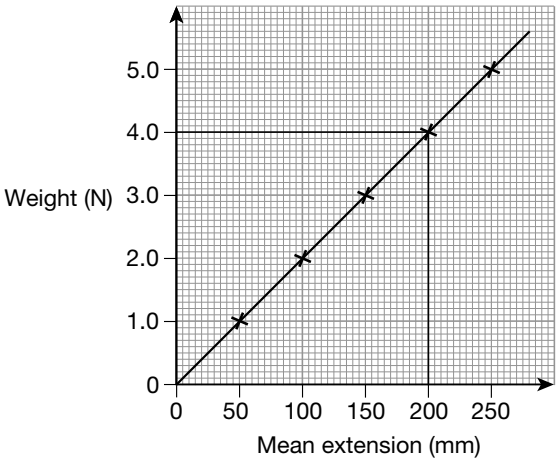
12.1	The time it takes for the number of nuclei of the isotopes in a sample to halve		1	AO1 4.4.2.3
12.2	3 days		1	AO2 4.4.2.3
12.3	The half-life of the sample is 3 days, so 12 days is 4 half-lives after the count started The activity at 9 days (3 half-lives) is 50 Bq So the activity at 12 days will be half the previous value, i.e. 25 Bq		1 1 1	AO3 4.4.2.3
TOTAL			**5**	

Paper 2

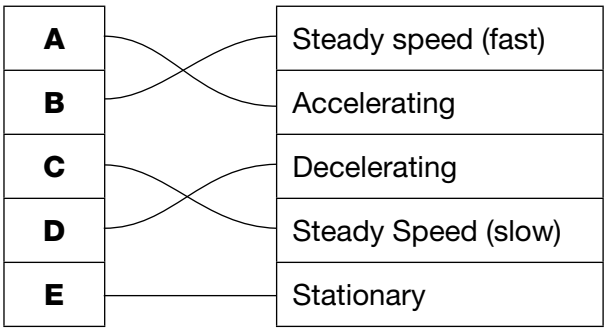
Question 01

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
01.1	Transverse	Accept spelling that is incorrect if very close	1	AO2 4.6.1.1 4.6.1.2
01.2	Wave or water molecules/ particles vibrate at right angles to direction of wave motion/ energy transfer		1 1	AO2 4.6.1.1 4.6.1.2 AO2
01.3	No she is wrong 36 / 6 = 6 cm 0.06 m	Not necessary to show working for conversion to metres	1 1 1	AO3 4.6.1.1 4.6.1.2 AO3 AO3 WS 4.3
01.4	Amplitude correctly labelled from the midpoint	Label from midpoint to crest or trough both acceptable	1	AO2 4.6.1.1 4.6.1.2
01.5	Frequency is the number of waves passing a point per second Period is the time it takes for one complete wave cycle/ oscillation/vibration	Accept correct alternative	1 1	AO1 4.6.1.1 4.6.1.2 AO1
01.6	$v = f \times \lambda$ or velocity = frequency × wavelength	In words or symbol form acceptable Penalise incorrect use of uppercase letters	1	AO1 4.6.1.1 4.6.1.2
01.7	$v = 6 \times 0.06$ 0.36 m/s	Allow error carried forward mark for incorrect answer from earlier if this value is substituted into equation	1 1	AO2 4.6.1.1 4.6.1.2 AO2
TOTAL			**12**	

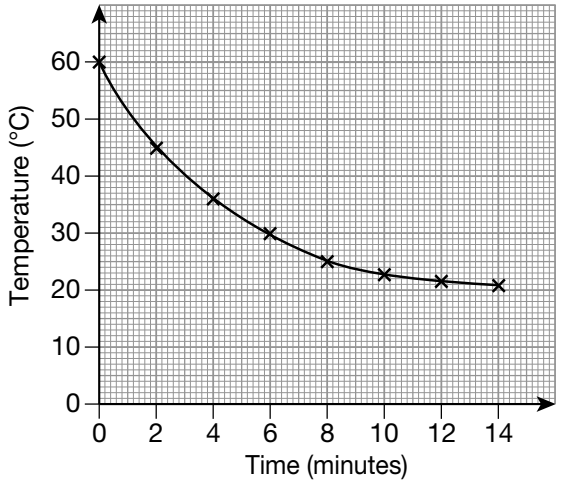
Question 02

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
02.1	correct means accept 49 | 100 | 150 | 200 | 250 or 49.5 | 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 for both marks	1 1	AO2 4.5.3 8.2.6 MS 2.b&f AO2 MS 2a
02.2	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
02.3	It is linear *or* Mean extension is (directly) proportional to weight	 (or vice versa)	1	AO3 4.5.3 8.2.6
02.4	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 03

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
03.1		1 mark for each correct response	5	AO1 4.5.6.1.4
03.2	45 m	Unit not required	1	AO3 4.5.6.1.4
03.3	$\frac{15}{2.5} = 6$	If 15 m seen and answer incorrect 1 mark only *or* If 2.5 s seen and answer incorrect award 1 mark only	2	AO3 4.5.6.1.2 4.5.6.1.4 7.4.a&d
	m/s	(both may not apply separately)	1	AO1 4.5.6.1.2 4.5.6.1.4 7.4.a&d
TOTAL			**9**	

Question 04

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
04.1	<table><tr><th>Mean</th></tr><tr><td>60</td></tr><tr><td>45</td></tr><tr><td>36</td></tr><tr><td>30</td></tr><tr><td>25</td></tr><tr><td>23</td></tr><tr><td>22</td></tr><tr><td>21</td></tr></table>	Accept non-rounded correct values Award one mark if at least 5 of the means are correct 1 mark for correct significant figures	2 1	AO2 8.2.10 MS 2.b&f
04.2	Points correctly plotted to within +/– one small square  Correctly drawn line of best fit	6–8 correct points for 2 marks 4–5 correct points for 1 mark only	2 1	AO2 8.2.10 MS4a&c AO3
04.3	Any **two** from the following: • Pour in the same volume of water • Ensure that the starting temperature is very close to the white can • Measure temp with the same time intervals over the same duration (OWTTE) • Ensure temperature in the room is similar. For example don't open the window if it was closed before (OWTTE)	Do not accept 'use the same thermometer'	2	AO3 8.2.10 WS 2.3 WS2.7
04.4	Line must start with a steeper gradient must level at the same temperature as the line for the white can		1 1	AO3 8.2.10 WS3.5 AO3

Question 04

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
04.5	Transfer/dissipation will take place to the surroundings via both **conduction** and **convection** as well		1	AO3
TOTAL			**11**	

Question 05

05.1	The hammer and the feather would land at the same time.		1	AO3 4.5.1.3
05.2	The hammer would hit the ground before the feather. (Unlike on the moon which has virtually no atmosphere) On Earth, air resistance has a great effect on the speed of the feather.	OWTTE OWTTE	1 1	AO3 4.5.1.3
05.3	$W = mg$ $m = \frac{W}{g} = \frac{3.2}{1.6}$ 2 kg	1st and 2nd marks can be awarded if rearranged or substituted correctly	1 1 1 1	AO2 4.5.1.3 MS 3b,c AO1
TOTAL			**7**	

Question 06

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
06.1	newton metres joules	If more than two boxes chosen penalise each incorrect response.	1 1	AO1 4.5.2
06.2	Energy transferred		1	AO1 4.5.2
06.3	Work done = force × distance Or $W = Fd$ = 500 × 15 m = 7500 J	Equation must be stated in words or correct symbols Unit not required	1 1 1	AO2 4.5.2 WS 4.5
TOTAL			**6**	

Question 07

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
07.1	4.5 m/s^2	$30^2 - 0^2 = 2as$ For 1 mark if final answer incorrect $a = \frac{900}{200} =$ For 1 mark if final answer incorrect [maximum of 1 mark for working if final answer incorrect] Accept $m\ s^{-2}$	2 1	AO2 4.5.6.1.5 AO1 MS 3b, 3c2
07.2	$a = \frac{\Delta v}{t}$ so $t = \frac{\Delta v}{a}$ $t = \frac{30}{4.5}$ = 6.7 s	1 mark for stating correct formula 1 mark for correctly rearranging and substituting 1 mark for correctly stating the answer. Maximum of 3 significant figures. Penalise incorrect rounding, i.e. do not accept 6.6	1 1 1	AO2 4.5.6.1.5 MS 1d, 3b, 3c
TOTAL			**6**	

Question 08

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
08.1	<table><tr><th>EM wave</th><th>Use or application</th></tr><tr><td>X-rays</td><td>To form images of broken bones</td></tr><tr><td>Ultraviolet or UV</td><td>In sunbeds</td></tr><tr><td>Infrared</td><td>In electrical heaters or 'heat-seeking' cameras</td></tr><tr><td>Microwaves</td><td>To send information to and from satellites or to cook food</td></tr></table>	1 mark for each correct response	1 1 1 1	AO1 4.6.2.4
TOTAL			4	

Question 09

09.1	$f = \frac{v}{\lambda} = \frac{3.0 \times 10^8}{100}$ $= 3.0 \times 10^6$ Hz	Correct rearrangement or correct substitution required Accept in standard form *or as* 3 000 000 *or* 3.0 M Penalise incorrect use of capitals or lowercase	1 1 1	AO2 4.6.1.2 MS 1c,3b,c AO2 AO1
TOTAL			3	

Question 10

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
10.1	small region receding		1 1	AO1 4.8.2 AO1
10.2	**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	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. • Tthis 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 11

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
11.1	remain stationary maintain the same speed acceleration inversely proportional $F = ma$		1 1 1 1 1	AO1 4.5.6.2 AO1 4.5.6.2.2 AO1 4.5.6.2.2 AO1 4.5.6.2.2 AO1 4.5.6.2.2
11.2	When two objects interact, the forces they exert on each other are equal and opposite.	OWTTE OWTTE	1 1	AO2 4.5.6.2.3 AO2
TOTAL			**7**	

Question 12

QUESTION	ANSWERS	EXTRA INFORMATION	MARK	AO / SPEC. REF.
12.1	Cobalt Iron		1 1	AO1 4.7.1.2 AO1
12.2	B C A		1 1 1	AO1 4.7.1.1 AO1 4.7.1.2 AO1 4.7.1.1
12.3	More turns or coils Greater current or voltage Inserting (soft) iron core		1 1 1	AO2 4.7.2.1
TOTAL			**8**	

Question 13

13.1	nebula gravity protostar fusion radiation equilibrium		1 1 1 1 1 1	AO1 4.8.1.2
13.2	Fusion processes in stars produce elements up to iron. Heavier elements than iron were produced in supernovae. The supernovae/explosion of massive stars distribute the elements throughout the Universe.		1 1 1	AO2 4.8.1.2
TOTAL			**9**	

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