Mark Scheme (Results)

Summer 2023

Pearson Edexcel GCSE
In Physics (1PH0)
Paper 1F

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

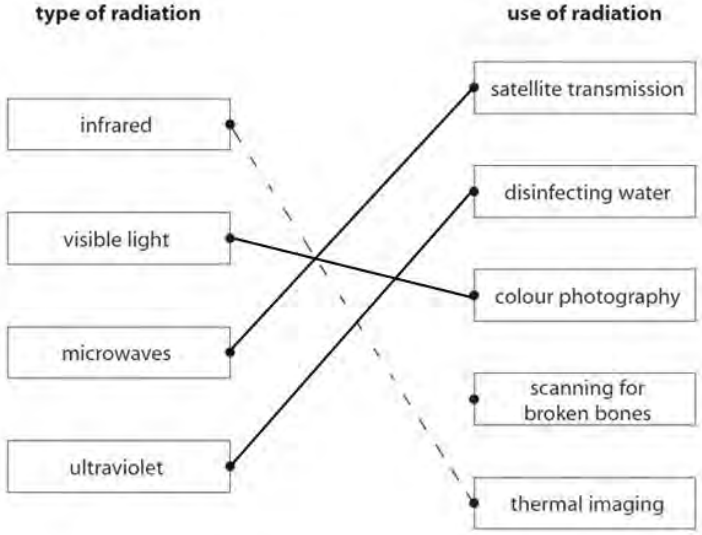
Mark schemes have been developed so that the rubrics of each mark scheme reflects the characteristics of the skills within the AO being targeted and the requirements of the command word. So for example the command word 'Explain' requires an identification of a point and then reasoning/justification of the point.

Explain questions can be asked across all AOs. The distinction comes whether the identification is via a judgment made to reach a conclusion, or, making a point through application of knowledge to reason/justify the point made through application of understanding. It is the combination and linkage of the marking points that is needed to gain full marks.

When marking questions with a 'describe' or 'explain' command word, the detailed marking guidance below should be consulted to ensure consistency of marking.

Assessment Objective		**Command Word**	
Strand	**Element**	**Describe**	**Explain**
AO1*		An answer that combines the marking points to provide a logical description	An explanation that links identification of a point with reasoning/justification(s) as required
AO2		An answer that combines the marking points to provide a logical description, showing application of knowledge and understanding	An explanation that links identification of a point (by applying knowledge) with reasoning/justification (application of understanding)
AO3	1a and 1b	An answer that combines points of interpretation/evaluation to provide a logical description	
AO3	2a and 2b		An explanation that combines identification via a judgment to reach a conclusion via justification/reasoning
AO3	3a	An answer that combines the marking points to provide a logical description of the plan/method/experiment	
AO3	3b		An explanation that combines identifying an improvement of the experimental procedure with a linked justification/reasoning

*there will be situations where an AO1 question will include elements of recall of knowledge directly from the specification (up to a maximum of 15%). These will be identified by an asterisk in the mark scheme.

Question Number	Answer	Additional guidance	Mark
1 (a) (i)		award one mark for each correct line up to three marks reject for a mark two lines starting or ending at the same box	**(3) AO1**

Question Number	Answer	Mark
1 (a)(ii)	C ultraviolet A (infrared), B (microwaves) and D (visible light) all have frequencies below that of ultraviolet	**(1) AO1**

Question Number	Answer	Additional guidance	Mark
1 (b)(i)	an explanation linking (X-rays/they) pass through/penetrate (the bags/cases) (1) to see contents/to show objects of greater density (1)	 accept see through accept look/see inside accept check contents/dangerous items	**(2) AO1**

Question Number	Answer	Additional guidance	Mark
1 (b)(ii)	an explanation linking X-rays/they are ionising (1) cause cancer/mutations (of cells/DNA) (1)	 accept harmful/dangerous accept a description of ionising accept high energy accept kill/damage cells	**(2) AO2**

Total for question 1 = 8mark

Question Number	Answer	Mark
2 (a)	**D** the reflected ray and the normal **A, B** and **C** do not describe the angle of reflection	**(1) AO1**

Question Number	Answer	Additional guidance	Mark
2 (b)(i)	Any one from:- to view distant objects /things far away (1) looking at planets /stars / space/ galaxies (1) bird watching (1)	 accept magnify distant objects accept other named astronomical objects	**(1) AO2**

Question Number	Answer	Mark
2 (b)(ii)	**C** P and Q are both converging **A** is incorrect the lens Q is not diverging **B** is incorrect the lens P is not diverging **D** is incorrect neither lens is diverging	**(1) AO3**

Question Number	Answer	Additional guidance	Mark
2 (b)(iii)	substitution (1) (power =) $\frac{1}{0.14}$ evaluation (1) 7.1 (D)	 7.14(28...) allow 7 award 1 mark for 7.1 to any other power of ten award 1 mark for correct answer as a fraction award full marks for the correct answer with no working	**(2) AO2**

Question Number	Answer	Additional guidance	Mark
2 (c)	a description including any two from window/light (from outside), lens and paper in correct order (1) move lens/paper (1) to focus (image) / to get a clear image (1)	 accept lens in front/behind window and paper in front/behind lens	**(2) AO2**

Total for question 2 = 7marks

Question Number	Answer	Mark
3 (a) (i)	**B** QR (horizontal line) **A** PQ is incorrect it shows constant acceleration **C** RS is incorrect it shows constant acceleration **D** ST is incorrect it shows constant deceleration	**(1) AO3**

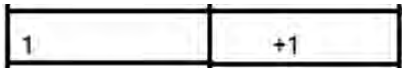
Question Number	Answer	Mark
3 (a)(ii)	**A** PQ (steeper slope shows greater acceleration) **B** QR is incorrect it shows zero acceleration **C** RS is incorrect as slope is less steep than for PQ **D** ST is incorrect as the slope is less steep than for PQ and shows deceleration	**(1) AO3**

Question Number	Answer	Additional guidance	Mark
3 (a)(iii)	substitution (1) (a=) $\frac{15(-0)}{10}$ evaluation (1) 1.5 (m/s^2)	 15 seen Allow 10 divided by any number between 6 and 7 for this mark award full marks for the correct answer with no working	**(2) AO3**

Question Number	Answer	Additional guidance	Mark
3 (a)(iv)	indication that distance travelled = area under graph (1) substitution (1) (distance travelled =) 10 x 15 evaluation (1) 150 (m)	may be seen on graph accept (distance=)speed x time ignore speed = <u>distance</u> time award full marks for the correct answer with no working award 2 marks for 10 x 15 seen anywhere if no other marks awarded, 1 mark for use of 15 (m/s) or 10 (s)	**(3) AO3**

Question Number	Answer	Additional guidance	Mark
3 (b)	substitution (1) (F=) 1200 x 2.4 evaluation (1) 2900 (N)	 accept 2880 (N) award one mark for power of ten error award full marks for the correct answer with no working	**(2) AO2**

Total for question 3 = 9marks

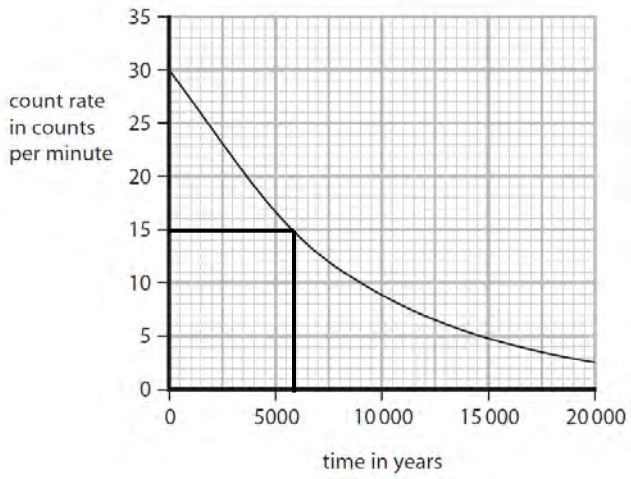
Question Number	Answer	Mark
4 a (i)	**C**  **A** is incorrect the proton has a mass of 1 not 0 **B** is incorrect the proton has a mass of 1 not 0 **D** is incorrect the proton has a charge of +1 not -1	**(1) AO1**

Question Number	Answer	Additional guidance	Mark
4 a(ii)	substitution (1) ratio = $\frac{10^{-10}}{10^{-15}}$ evaluation (1) 10^{5}	$10^{-10} : 10^{-15}$ accept suitable equivalent ratios e.g. $1 \times 10^{5} : 1$ $1 : 10^{-5}$ or $10^{5} : 1$ 1: 0.00001 or 100000:1 allow 1 mark for inverted ratios e.g. $10^{-15}: 10^{-10}$ 0.00001:1 or 1:100000 award full marks for the correct answer with no working	**(2) AO2**

Question Number	Answer	Additional guidance	Mark
4 a(iii)	an explanation linking same number / amount of (1) electrons and protons (1)	 equal number / amount of allow balanced (number / amount of) negative and positive charges ignore (neutral) neutrons reject positive/negative neutrons for 2nd marking point	**(2) AO1**

Question Number	Answer	Additional guidance	Mark
4 (b)(i)	6 / six		**(1) AO1**

Question Number	Answer	Additional guidance	Mark
4 (b)ii	8 / eight		**(1) AO2**

Question Number	Answer	Additional guidance	Mark
4 (b)(iii)	indication of horizontal line between 14 and 16 and / or vertical line between 5250 and 6250 (1)  value between 5250 (years) and 6250 (years) inclusive (1)	accept alternative indications e.g. cross on curve accept any halving pairs e.g. going between 20 cpm and 10 cpm award full marks for the correct answer with no working	**(2) AO3**

Total for question 4 = 9 marks

Question Number	Answer	Mark
5 (a)(i)	**B** the line shows the amplitude **A** is incorrect the line shows twice the amplitude **C** is incorrect the line shows half the wavelength **D** is incorrect the line shows the wavelength	**(1)** **AO1**

Question Number	Answer	Additional guidance	Mark
5 (a)(ii)	an explanation linking vibration/oscillation (1) perpendicular / at right angles / 90º (to the direction of travel of the wave/direction of energy transfer) (1)	 accept up and down	**(2)** **AO1**

Question Number	Answer	Additional guidance	Mark
5 (b)(i)	a description including count the number of waves/ripples (1) (that pass a point) in a certain time (1) OR measure the time for a certain number of waves/ripples (1) use of f = 1/T (1)	 accept use of numerical values calculate the number of waves that pass the point in a second scores 2 marks	**(2)** **AO1**

Question Number	Answer	Additional guidance	Mark
5 (b)(ii)	a description including any two from the waves/ripples are made to look stationary (1) measure the distance across a number of waves/wave fronts/ripples (1) calculate the wavelength from the measurements (1)	 using camera, video, strobe light, stroboscope, mobile, phone, photo(graph) accept measure the distance across a number of lines divide distance by the number of waves/ripples accept the idea of measuring the distance between one wave/ripple/line and another (successive) wave/ripple/line for 2 marks	**(2) AO1**

Question Number	Answer	Additional guidance	Mark
5 (c)	substitution (1) 0.8 =f x 4.0 rearrangement and evaluation (1) 0.2 (Hz) unit (1) Hz / s^{-1}/ per sec	 (f =) $\frac{0.8}{4.0}$ allow correct substitution into seen incorrect rearrangement award 2 marks for the correct answer with no working accept hz or hertz independent mark accept recognisable spelling	**(3) AO2**

Total for question 5 = 10marks

Question Number	Answer	Additional guidance	Mark
6 (a)(i)	any value between 21 and 54 inclusive		**(1) AO3**

Question Number	Answer	Additional guidance	Mark
6 (a)(ii)	any one from distance / separation (1) time (exposure) (1)		**(1) AO3**

Question Number	Answer	Additional guidance	Mark
6 (a)(iii)	Any one from poor conductor / reduces energy loss / (good) insulator (1) same height as detector (1)	allow heat loss for energy loss accept wood stops heat loss accept it does not conduct heat	**(1) AO3**

Question Number	Answer	Additional guidance	Mark
6 (b)	a description including any two from (at low wavelength) intensity increases (as wavelength increases) (1) after peak/at long wavelengths intensity decreases (as the wavelength increase)(1) intensity peaks between 7 and 10(μm) or between 1.0 and 1.2 ($\mu W/m^2$) (1)	allow use of data from the graph to indicate the peak	**(2) AO3**

Question Number	Answer	Additional guidance	Mark
6 (c)	a description including any four from **one** method **Using temperature change method:** any one control (1) start the stopclock and switch on the heater (at the same time) (1) measure over a certain time (1) measure final temperature of each (1) largest temperature difference/rise gives better absorbing surface (1) **Using time change method:** any one control (1) switch on the heater and start the stopclock (at the same time) (1) measure time taken (1) to reach a certain temperature (1) quickest time to reach a certain temperature gives better absorbing surface (1)	allow testing each can separately (two experiments) same distance from heater same volume/mass of water allow same volume/surface area of cans lids on both cans start the stopclock and measure initial temperature (at the same time) Accept 'highest temperature is better' same distance from heater same volume/mass of water allow same volume/surface area of cans lids on both cans accept 'fastest (to reach temperature) is better'	**(4)** **AO1**

Total for Question 6 =9 marks

	Answer	Mark
7 (a)	**D** gamma **A,B** and **C** all carry a charge	**(1) AO1**

	Answer	Mark
7 (b)	**A** alpha **B,C,** and **D** travel too far in air and are not sufficiently ionising	**(1) AO1**

	Answer	Additional guidance	Mark
7 (c)(i)	beta, beta (minus), β, β^-	accept beta(plus), β^+	**(1) AO1**

	Answer	Additional guidance	Mark
7 (c)(ii)	Geiger-Muller (tube)/ G-M (tube)/ GM (tube)/ Geiger (counter)	accept ratemeter do not accept radiation meter accept phonetic spellings e.g. Giga	**(1) AO1**

	Answer	Additional guidance	Mark
7 (c)(iii)	one from more (radiation) passes through (the paper) (1) OR less (radiation) is absorbed (by the paper) (1) OR less paper (for radiation) to pass through/penetrate(1)	penetrates/gets through allow easier to pass through Ignore name of particle if given	**(1) AO2**

	Answer	Additional guidance	Mark
7 c(iv)	Calculation of 5% of count rate (1) $\frac{4000 \times 5}{100}$ or 4000 x 0.05 = 200 evaluation (1) 4000 +200 = 4200	accept use of any percentage between 4% and 5% accept any value between 160 and 200 ecf for addition of incorrect calculated percentage and 4000 award full marks for any answer that rounds to 4200 without working	**(2) AO2**

Question number	Indicative content	Mark
7 * (d)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. AO1 **Diagnosis** Tracers radioactive sources swallowed by or injected into patients travel around the body emit gamma radiation (from radioactive decay) gamma radiation passes out through the body detected outside the body with a gamma camera PET Scanner (more of) the tracer goes to the cancer cells gamma radiation is emitted (gamma rays) from/in different directions gamma detected by gamma cameras (3D) pictures produced on a computer screen Named tracer, e.g. technetium, iodine, fluorine **Treatment** Radiotherapy Use of gamma rays/x-rays kills cancer (cells) radiating small area of body (with gamma rays/X rays) radiation used for a short time (gamma rays) from/in different directions brachytherapy radioactive sources inside the body may not be removed put close to cancerous tumour **Ignore references to chemotherapy**	(**6)** **AO1**

Level	Mark	Descriptor
	0	• No rewardable material.
Level 1	1-2	• Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents a description with some structure and coherence. (AO1)
Level 2	3-4	• Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents a description that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5-6	• Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents a description that has a well-developed structure which is clear, coherent and logical. (AO1)

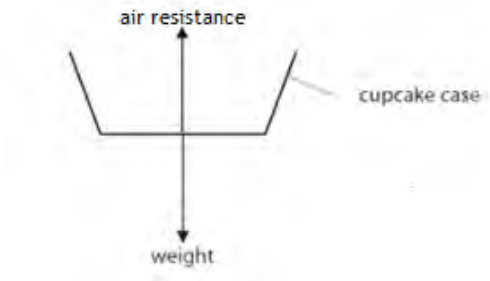
Level	Mark	Additional Guidance	General additional guidance – the decision within levels e.g. - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	<u>Additional guidance</u> isolated facts about cancer diagnosis or cancer treatment using radioactivity OR limited description about cancer diagnosis **or** limited description about cancer treatment using radioactivity OR allow isolated facts about cancer diagnosis using x-rays, C(A)T scans, MRI, ultrasound for level 1 if no other mark scored	<u>Possible candidate responses</u> Uses/emits gamma (rays) can kill cancer(ous) cells radiotherapy Cancer is treated using gamma rays CT scan is used to find tumours
Level 2	3–4	<u>Additional guidance</u> limited description about cancer diagnosis **and** limited description about cancer treatment using radioactivity OR detailed description of either cancer diagnosis or treatment using radioactivity	<u>Possible candidate responses</u> PET scans are used in diagnosis and radiotherapy is used to treat cancer OR Cancer is treated using gamma rays, the gamma rays kill the cancer cells
Level 3	5–6	<u>Additional guidance</u> detailed description about either diagnosis OR cancer treatment using radioactivity AND limited description about either cancer treatment OR diagnosis using radioactivity	<u>Possible candidate responses</u> Tracers are used in diagnosis and radiotherapy uses gamma rays to kill cells. OR Tracers emit gamma rays which pass out through the body and radiotherapy uses x-rays

Total Question 7 =13marks

Question Number	Answer	Additional guidance	Mark
8 (a)	**B** distance **A,C**, and **D** are incorrect as these are vector quantities		**(1) AO1**

Question number	Answer	Additional guidance	Mark
8 (b)(i)	A description to include any 4 from: measure height (1) measure time of fall (1) use (average) speed=distance ÷ time (1) repeat with different number of cupcake cases in the stack/more cupcake cases (1) repeat **and** average time (of fall for each stack of cupcake cases) (1) plot a graph (speed of fall against number of cupcake cases dropped) (1)	 allow 'keep same height' allow in this context hold against (fixed point on) metre rule allow 'time it' accept cupcakes for cupcake cases	**(4) AO1**

Question Number	Answer	Additional guidance	Mark
8 (b)(ii)	substitution (1) (W=)0.005 x 10 evaluation (1) 0.05 (N)	 5×10^{-2} (N) do not allow power of ten error award full marks for the correct answer with no working give full credit for use of g=9.8 or 9.81 N/kg	**(2) AO2**

Question number	Answer	Additional guidance	Mark
8 (b)(iii)	 air resistance arrow (1)	judge by eye any vertical upward arrow outside or inside the cupcake case ignore length of arrow arrow need not touch cupcake holder ignore label on arrow	**(1) AO2**

Question number	Answer	Additional guidance	Mark
8 (b) (iv)	zero / there is none / 0 / it has no acceleration	ignore 'constant' ignore units	**(1) AO2**

Question number	Answer	Additional guidance	Mark
8(c)	substitution (1) (change in velocity=) 3 x 7 evaluation (1) 21 (m/s)	 award full marks for the correct answer with no working	**(2)** **AO2**

Total for question 8 = 11marks

Question number	Answer	Additional guidance	Mark
9 (a)(i)	substitution (1) 11 = 0.42 x 10 x Δh rearrangement (1) (Δh =) $\frac{11}{0.42 \times 10}$ evaluation (1) 2.6 (m)	 accept substitution and rearrangement in either order (Δh =) $\frac{\Delta GPE}{m \times g}$ accept any value which rounds to 2.6 (m) award 2 marks for 2.6 to any other power of 10 allow 1 mark for 0.38 allow 1 mark for 46(.2) award full marks for the correct answer with no working give full credit for use of g=9.8 or 9.81 N/kg (gives 2.7 (m))	**(3) AO2**

Question number	Answer	Additional guidance	Mark
9 (a)(ii)	substitution(1) (KE=)$\frac{1}{2}$ x 0.42 x 12^2 evaluation (1) 30 (J)	 allow 30.2(4) (J) award 1 mark for 30 240 (J) award 1 mark for 2.52 (J) award 1 mark for 60.5 (J) award full marks for the correct answer with no working	**(2) AO2**

Question number	Answer	Additional guidance	Mark
9 (a)(iii)	A description including: KE/kinetic (energy store) (1) (transfers to) and **one** of: elastic (potential energy store) (1) OR thermal (energy of ball/wall/surroundings) (1) OR <u>dissipates</u> (to surroundings) (1)	 allow mechanically / mechanical transfer ignore reference to gravitational potential energy allow heat for thermal allow sound in this context ignore reference to the ground	**(2)** **AO2**

Question number	Indicative content	Mark
9*(b)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO2,AO3** **Non-renewable sources of energy** trend: less used/decrease in use (between 2012 and 2019) **fossil fuels** coal, gas, oil are running out / finite resource / sustainability argument produce carbon dioxide/ sulphur dioxide/ greenhouse gases (when burned) in power stations cause pollution/ smoke particles /damage to the environment causes climate change / global warming production of greenhouse gases needs to be reduced (for Britain to become carbon neutral) **nuclear fuels** no carbon dioxide produced radioactive waste produced safety concerns **Renewable sources of energy** trend: more used /increase in use (between 2012 and 2019) renewable and non-renewable about equally used from 2019 solar, wind, hydroelectric, tidal, geothermal, wave and biomass never run out / are sustainable do not produce carbon dioxide/ greenhouse gases (except biomass) slow down climate change / global warming	**(6)** **AO2, AO3**

Level	Mark	Descriptor
	0	• No awardable content
Level 1	1–2	• Interpretation and evaluation of the information attempted but will be limited with a focus on mainly just one variable. Demonstrates limited synthesis of understanding. (AO3) • The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2)
Level 2	3–4	• Interpretation and evaluation of the information on both variables, synthesising mostly relevant understanding. (AO3) • The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2)
Level 3	5–6	• Interpretation and evaluation of the information, demonstrating throughout the skills of synthesising relevant understanding. (AO3) • The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2)

Level	Mark	Additional Guidance	General additional guidance – the decision within levels e.g. - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	Additional guidance isolated facts about the resources, non-renewable or renewable **OR** the trend(s) in usage	Possible candidate responses coal is non-renewable and solar is renewable non-renewables are decreasing and renewables are increasing non-renewable resources are higher on (most of) the graph
Level 2	3–4	Additional guidance trend(s) **AND** limited explanation of the renewable trend **OR** limited explanation of the non-renewable trend	Possible candidate responses use of renewable resources is increasing because renewables are sustainable OR use of non-renewable resources are decreasing because they cause global warming
Level 3	5–6	Additional guidance both trends **AND** detailed explanation of one trend **AND** some explanation of the other trend	Possible candidate responses use of renewable resources are increasing **and** the use of non-renewable resources are decreasing because non-renewable resources are running out **and** wind turbines do not produce carbon dioxide

Total for question 9 =13 marks

	Answer	Additional guidance	Mark
10 (a)(i)	(1.98-1.86) = (+/-) 0.12		**(1)** **AO2**

	Answer	Additional guidance	Mark
10(a)(ii)	(velocity =) $\frac{330 \times 0.12}{1.86}$ (1) (+/-) 21.3 (m/s) (1)	ecf from 10ai accept numbers that round to 21 (m/s) award 1,2 marks for (i) and (ii) for the correct answer for (ii) even without working	**(2)** **AO2**

	Answer	Additional guidance	Mark
10(b)	(there is) an increase in wavelength (of light) (1) shows galaxies are moving away (from Earth) (1)	allow wavelength stretches allow red shift ignore shift to red end of spectrum ignore objects / stars / planets	**(2)** **AO1**

	Answer	Additional guidance	Mark
10(c)	1(.0) (1) mm (1)	Allow values between 1.0 and 1.9 allow 1×10^{-3} m or 0.001 m for 2 marks if nothing in answer line, credit answer indicated in table	**(2)** **AO3**

	Answer	Additional guidance	Mark
10 d(i)	gravitational attraction / gravitational force (causing collapse) (1)	allow gravity ignore weight ignore gpe ignore gravitational energy	**(1)** **AO1**

	Answer	Additional guidance	Mark
10 d(ii)	An explanation linking: (gravity causing) increase in temperature (1) (until hot enough for) fusion (1) (until) balance (between gravity and fusion/thermal) (1)	 allow increase in pressure/density hydrogen to form helium allow nuclear reactions ignore fission allow equilibrium / counteracts	**(3)** **AO1**

Total for Question 10 = 11 marks.