Mark Scheme
Results

Summer 2022

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	Mark
1(a)(i)	**A ray box** ***B*** *is not correct because a ruler does not produce a beam of white light* ***C*** *is not correct because a measuring cylinder does not produce a beam of white light* ***D*** *is not correct because an ammeter does not produce a beam of white light*	**(1)** **AO1**

Question Number	Answer	Mark
1(a)(ii)	**C green** ***A*** *is not correct because red appears at the start of the spectrum* ***B*** *is not correct because orange appears in the middle of the spectrum* ***D*** *is not correct because violet appears at the end of the spectrum*	**(1)** **AO1**

	Answer	**Additional guidance**	**Mark**
1(b)(i)	x-ray(s)	allow X x no mark if more than one wave given e.g. x-rays and gamma rays scores 0	**(1)** **AO1**

	Answer	**Additional guidance**	**Mark**
1(b)(ii)	infrared	allow any recognisable spelling IR ir no mark if more than one wave given e.g. infrared and gamma rays scores 0	**(1)** **AO1**

	Answer	Additional guidance	Mark
1(b)(iii)	infrared	allow any recognisable spelling IR ir no mark if more than one wave given e.g. infrared and gamma rays scores 0	**(1)** **AO1**

	Answer	Additional guidance	Mark
1(b)(iv)	gamma (rays)	allow any recognisable spelling y no mark if more than one wave given e.g. gamma rays and UV scores 0	**(1)** **AO1**

(Total for Question 1= 6 marks)

	Answer	Additional guidance	Mark
2(a)(i)	12		**(1)** **AO1**

	Answer	Additional guidance	Mark
2(a)(ii)	$\frac{42}{12}$ (1) 3.5 (cm) (1)	 ecf from2ai allow 0.035 for 1 mark award full marks for the correct answer without working	**(2)** **AO1**

	Answer	Additional guidance	Mark
2(a)(iii)	A description to include: **either** time a crest/ripple/wavefront (1) (moving) between **P** and **Q** (1) use (wave speed =) $\frac{\text{distance}}{\text{time}}$ (1) **or** count number of crests /ripples /wavefronts passing (eg P) (1) in a given time (to find f) (1) use ($v = f\lambda$) (1)	 allow **'**how long it takes' allow 'wave' for crest allow – over the 42 cm over a (set) distance allow waves if no other mark scored measure frequency for 1 mark	**(3)** **AO1**

Question Number	Answer	Mark
2(b)(i)	**A** longitudinal yes ***B*** *is not correct because sound waves can transfer energy* ***C*** *is not correct because sound waves are longitudinal* ***D*** *is not correct because sound waves are longitudinal and sound waves can transfer energy*	**(1)** **AO1**

	Answer	**Additional guidance**	**Mark**
2(b)(ii)	select wave equation (1) *(v =) f × λ* evaluation (1) (speed =) 330 (m/s)	 (speed =) freq(uency) × wavelength (speed =) 440 × 0.75 award full marks for the correct answer without working.	**(2)** **AO2**

(Total for Question 2 = 9 marks)

	Answer	Additional guidance	Mark
3(a)(i)	diagram to include: a re**flect**ed ray drawn (1) angle of reflection = angle of incidence (1)	 judge by eye	**(2)** **AO2**

	Answer	Additional guidance	Mark
3(a)(ii)	diagram to include: a re**fract**ed ray drawn (1) angle of refraction < angle of incidence (1)	 Ray drawn in bottom right quadrant of diagram ignore reflected rays judge by eye	**(2)** **AO2**

	Answer	Additional guidance	Mark
3(a)(iii)	diagram to include: ray drawn showing total internal reflection (1) angle of reflection = angle of incidence (1)	 REJECT any refracted ray for this mark judge by eye	**(2)** **AO2**

	Answer	Additional guidance	Mark
3(b)	substitution (1) evaluation without correct unit change (1) evaluation including unit change (1) 2.5 (dioptres)	(power) = $\frac{1}{0.40}$ allow 4 to any power of 10 in the substitution allow 2.5 to any power of 10 (dioptres) 2.5 to any other power of 10 scores 2 marks award full marks for the correct answer without working	**(3)** **AO2**

(Total for Question 3 = 9 marks)

	Answer	Additional guidance	Mark
4(a)	substitution (1) (*ΔGPE* =) 57 × 10 × 2.1 evaluation (1) (*ΔGPE* =) 1200 (J)	 ignore attempts to convert kg to g for this MP only 1197 allow numbers that round to 1200 no ecf from MP1 award full marks for the correct answer without working.	**(2)** **AO2**

	Answer	Additional guidance	Mark
4(b)	select correct equation (1) $KE = ½ \times m \times v^2$ substitution (1) (*KE* =) ½ × 70 × 8(.0)$^{(2)}$ evaluation (1) (*KE* =) 2200 (J)	 ignore attempts to convert kg to g for this MP only allow numbers that round to 2200 e.g. 2240 280 or 35 x 8 seen scores 2 marks award full marks for the correct answer without working.	**(3)** **AO2**

	Answer	Additional guidance	Mark
4(c)(i)	0.54 (s)	allow any value from 0.53 and 0.55 inclusive	**(1)** **AO3**

	Answer	Additional guidance	Mark
4(c)(ii)	curve extended to α = 80° (1) 0.45 (s) (1)	judge generously allow range 0.42 to 0.48 award full marks for the correct answer without working.	**(2)** **AO3**

	Answer	Additional guidance	Mark
4(c)(iii)	mention/idea of reaction time (1) (reaction time) about the same as the times on the graph (1)	human reaction time is about 0.2 seconds (compared with) 0.4 seconds on the graph ignore accuracy ignore "human error"	**(2)** **AO3**

(Total for Question 4 = 10 marks)

	Answer	Additional guidance	Mark
5(a)(i)	nebula (1)	allow any recognisable spelling	**(1)** **AO1**

	Answer	Additional guidance	Mark
5(a)(ii)	main sequence (1)	allow any recognisable spelling	**(1)** **AO1**

	Answer	Additional guidance	Mark
5(b)(i)	**B** red giant (1)		**(1)** **AO1**

Question Number	Answer	Mark
5(b)(ii)	**D** black hole	**(1)** **AO1**

	Answer	Additional guidance	Mark
5(c)(i)	one from: high temperature (1) high pressure (1) high (particle) density (1) high (particle) speed / KE (1)	allow 'heat' for 'temperature' in this context	**(1)** **AO1**

	Answer	Additional guidance	Mark
5(c)(ii)	description to include: (two) isotopes/nuclei/atoms (1) fusing (1)	 hydrogen allow joining / coming together / bonding IGNORE collide	**(2)** **AO2**

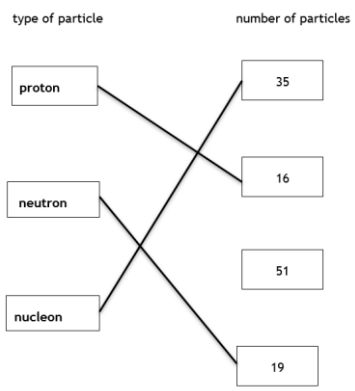
	Answer	Additional guidance	Mark
5(c)(iii)	substitution (1) $\underline{1.32 (\times 10^3)}$ $4.92 (\times 10^2)$ evaluation (1) 2.68	 accept 110 : 41 for 2 marks 11 : 41 for 1 mark POT error scores 1 award full marks for the correct answer without working	**(2)** **AO2**

(Total for Question 5 = 9 marks)

	Answer	Additional guidance	Mark
6(a)(i)	**One** from: cell damage (1) cancer (1) radiation sickness / poisoning (1) mutation (1) chromosomal damage (1) dna damage (1) skin damage (1) (named) organ damage (1) burns (1) releases ionising radiation (1)	allow ionises / kills cells	**(1)** **AO1**

	Answer	Additional guidance	Mark
6 (a)(ii)	**any one** from: Geiger (Muller) (tube/counter) photographic film dosimeter	accept recognisable spellings GM film badge	**(1)** **AO1**

	Answer	Additional guidance	Mark
6(a)(iii)	**any two** from: beta(minus)/β(-) (1) beta + (1) x-rays (1) gamma/γ (1)	accept positron in place of beta + accept proton beam accept electron beam maximum of 1 mark if one incorrect radiation given zero marks if two incorrect radiations given	**(2)** **AO1**

	Answer	Additional guidance	Mark
6(b)		1 mark for each correct line more than one line from a box in the left column ("type of particle") box loses the mark for the box	**(3)** **AO2**

	Answer	Additional guidance	Mark
6(c)(i)	260 (g)		**(1)** **AO2**

	Answer	Additional guidance	Mark
6(c)(ii)	(54 days is) 3 half-lives (1) 65 (1)	260 ÷ 2 (÷ 2) or 520 ÷ 2 ÷ 2 (÷ 2) 18, 36, 54 (represents 3 half-lives) 54/18 = 3 (half-lives) ecf answer to 6ci ÷ 4 130 scores 1 mark award full marks for the correct answer without working	**(2)** **AO2**

Total for Question 6 = 10 marks

	Answer	Additional guidance	Mark
7(a)(i)	substitution (1) 12 x 10 evaluation (weight =) 120 (N)		**(2)** **AO2**

	Answer	Additional guidance	Mark
7(a)(ii)	rearrangement (1) (g) = W / m substitution (1) 20 / 12 evaluation (1) (g on Moon =)1.7 (N/kg)	rearrangement and substitution in either order accept answers that round to 1.7 e.g. 1.67 (N/kg) award full marks for the correct answer without working 1.6 scores 2 marks 240 scores 1 mark 0.6 scores 1 mark 20 × 12 scores 1 mark 12 / 20 scores 1 mark	**(3)** **AO3**

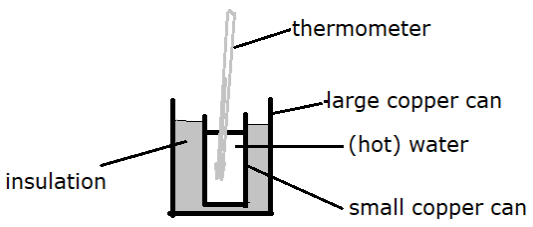
Question number	Indicative content	Mark
***7(b)**	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1** • planet names: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune • planet(s) orbit the Sun • all planets orbit the Sun • each planet in its own orbit • (all) planet orbits are in the same plane • planets spin (on own axis) • moons orbit planets • some planets have multiple moons • dwarf planets orbit the Sun • asteroids orbit the Sun • comets orbit the Sun • comet orbits not in the same plane as planets	**(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	Additional guidance isolated facts about the objects or the patterns of movement	Possible candidate responses names at least 2 planets
Level 2	3–4	Additional guidance Detailed description of pattern of movement for **one** set of objects. **OR** limited description of pattern of movement for **two** set of objects	Possible candidate responses planets orbit the Sun **AND** moons orbit planets
Level 3	5–6	Additional guidance Detailed descriptions of pattern of movement for **two** sets of objects. **OR** Detailed description of pattern of movement for **one** set of objects plus limited description for **two** sets.	Possible candidate responses all planets orbit the Sun, comets orbit the Sun, asteroids orbit the Sun

(Total for Question 7 = 11 marks)

Question Number	Answer	Mark
8(a)	**B. when there are energy transfers, the total energy does not change** ***A*** *is not correct because the total energy does not reduce* ***C*** *is not correct because the total energy does not increase* ***D*** *is not correct because there must be no net change in the total energy*	**(1)** **AO1**

Question Number	Answer	Additional guidance	Mark
8(b)(i)	A diagram showing: apparatus labelled to include **three** from • thermometer • water • insulator / sand / sawdust/ material • (copper) can (1) thermometer in the **water** (1) arrangement for water and insulator in and between copper cans (e.g. as in diagram below) (1)  	independent of arrangement ignore kettle and stop clock accept reverse positions for water and insulator	**(3)** **AO2**

Question Number	Answer	Additional guidance	Mark
8(b)(ii)	any **three** factors from: {mass / volume} of water (1) {volume / thickness / mass} of insulators /materials (1) {starting / initial} temperature of water (1) time interval / temperature change (1)	 accept amount / specified values / "how much" accept amount / specified values / "how much" accept temperature of hot / boiling water / specified values accept specified values of interval or change unqualified "same time" is insufficient	**(3)** **AO3**

	Answer	Additional guidance	Mark
8(c)	a description giving as the density (of expanded polystyrene) increases the (thermal) conductivity decreases (1) non-linear / gradient decreases / at a decreasing rate / levels off / plateaus / becomes (almost) constant (1)	 ORA allow inversely proportional / exponential for non-linear in this context ignore negative correlation unqualified quoted values are insufficient	**(2)** **AO3**

	Answer	Additional guidance	Mark
8(d)(i)	600 (J)	accept 3000 – 2400 accept -600	**(1)** **AO3**

	Answer	Additional guidance	Mark
8(d)(ii)	substitution (1) (efficiency =) $\frac{2400}{3000}$ evaluation (1) 0.8(0)	 allow $\frac{4}{5}$ accept 80 (%) award full marks for the correct answer without working allow 1.25 for 1 mark for selecting and evaluating from the correct pair of values	**(2)** **AO3**

(Total for Question 8 = 12 marks)

	Answer	Additional guidance	Mark
9 (a)(i)	an explanation linking **two** from: (wet road means) less / no friction (between tyres and road) (1) (wet weather means) increased stopping distance (1) (slower speed means) shorter braking / stopping distance (1) (dry weather / slower speed) reduces possibility of skidding / sliding / idea of losing control / crashing (1)	accept reverse arguments throughout accept road more slippery / less grip accept idea of reduced visibility accept braking or thinking distance in this context accept takes longer to slow down / stop ignore harder to brake	**(2)** **AO1**

	Answer	Additional guidance	Mark
9(a)(ii)	convert **either** distance or time (1) (31 m =) $\frac{31}{1000}$ (km) or 0.031 (km) **OR** (1 s =) $\frac{1}{3600}$ (h) = $\frac{1}{60\times60}$ (h) or 0.000 28 (h) evaluation (1) (31 m/s =) 110 (km/h)	 (130 km =) 130 × 1000 (m) or 130 000 (m) **OR** (1 h =) 60 x 60 (s) or 3600 (s) (130 km/h =) 36(.1) (m/s) accept 111.6 or 112 (km/h) for 2 marks if no other marks awarded accept <u>1860 m/min</u> and <u>2167 m/min</u> for 1 mark each award full marks for the correct answer without working	**(2)** **AO2**

	Answer	Additional guidance	Mark
9(a)(iii)	select and substitute into distance travelled = average speed x time (1) 46 = 31 x t rearrangement and evaluation (1) (t=) 1.48(3) (s) evaluation given to 2 sf (1) (t =) 1.5 (s)	 31 = $\frac{46}{t}$ (t =) $\frac{46}{31}$ award two marks for the correct evaluation without working any answer written to 2 sf independent mark 1.5 scores 3 marks 1.4 scores 2 marks 1.50 scores 2 marks 0.67 scores 2 marks 1400 scores 2 marks 0.673(9) scores 1 mark 1426 scores 1 mark	**(3)** **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. **AO3** • graph starts at zero • graph increases to a maximum at 2 s • graph stays constant for 2.6 s • graph decreases to zero at 6 s • graph stays at zero after 6 s • graph decreases steeply until 5 s • graph decreases less steeply until 6 s • graph at zero between 6 and 7s **AO2** • velocity is zero at time zero • velocity increases/train accelerates until 2 s • velocity is constant for 2.6 s • velocity decreases/train decelerates until 6 s • deceleration changes at 5 s • acceleration is gradient of graph • velocity zero between 6 and 7 s	**(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 description 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 description 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 description 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 movement of the train or the shape of the graph	Possible candidate responses the train speeds up and slows down
Level 2	3–4	Additional guidance Description of motion in at least 2 parts of the graph. At least one of those parts linked to data from the graph.	Possible candidate responses the train speeds up for the first 2 seconds then stays at a constant speed
Level 3	5–6	Additional guidance Description of motion in at least 3 parts of the graph. At least two of those parts linked to data from the graph.	Possible candidate responses the train speeds up for the first 2 seconds then stays at a constant speed for 2.6 seconds then slows down

Total for Question 9 = 13 marks

Question Number	Answer	Mark
10 (a)(i)	**D gamma** ***A*** *is not correct because alpha cannot pass through and out of the body* ***B*** *is not correct because beta plus cannot pass through and out of the body* ***C*** *is not correct because beta minus cannot pass through and out of the body*	**(1)** **AO1**

	Answer	**Additional guidance**	**Mark**
10(a)(ii)1	decays too quickly to give a reading (1)	accept (half-life) not long enough for reading to be taken Ignore disappear after 12 min	**(1)** **AO1**

	Answer	**Additional guidance**	**Mark**
10(a)(ii)2	stays in the body too long (1)	accept could harm/damage other organs patients stay radioactive for too long so the patient does not get too high a dose of radiation	**(1)** **AO1**

	Answer	Additional guidance	Mark
10(a)(iii)	**Two** from: shielding (1) time limiting exposure (1) distance limiting exposure (1) wear PPE / protective clothing (1)	 accept stand behind barriers / store (source) in lead box radiation monitoring badges leave the room/ go outside/stay away from the patient / use tongs lead aprons / gloves ignore goggles / masks	**(2)** **AO1**

	Answer	Additional guidance	Mark
10 (b)(i)	an explanation linking: (control rods) absorb <u>neutrons</u> (1) (so) fewer (neutrons) available for chain reaction (1)	ignore slow down the nuclear chain reaction accept (control rods) block <u>neutrons</u> accept <u>neutrons</u> can't pass through (control rods) fewer fission(s) (reactions)	**(2)** **AO1**

	Answer	Additional guidance	Mark
10 (b)(ii)	$\frac{4(.0 \times 10^3)(\times 100)}{3(.0 \times 10^7)}$ (1) 1.3×10^{-2} (%) (1)	 0. 013 (%) allow 0.01 (%) power of ten error scores 1 mark maximum award full marks for the correct answer without working	**(2)** **AO2**

	Answer	Additional guidance	Mark
10 (b)(iii)	A description to include: (from) kinetic energy (of fission fragments) (1) (transferred to) thermal energy (of coolant) (1)	accept references to energy stores accept energy in nuclear store accept nuclear energy / gamma radiation energy / binding energy / mass (to) thermal store (in coolant) accept heat for thermal allow steam transfers thermal energy/heat from reactor to kinetic energy of turbine for 2 marks	**(2)** **AO1**

Total Question 10 =11 marks