Mark Scheme (Results)

Summer 2024

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.

Question number	Answer	Additional guidance	Mark
1 (a)	transverse (1) speed (1) frequency (1)	must be in correct order. allow any recognisable spelling.	**3 AO1.1**

Question number	Answer	Additional guidance	Mark
1 (b)	(visible) light (1) gamma (rays) (1) radio (waves) (1) ultraviolet (waves) (1)	 γ (rays) allow microwaves UV (rays)	**4 AO3.3**

Total for question 1 =7 marks

Question number	Answer	Additional guidance	Mark
2(a)	blue		**1** **AO3.2**

Question number	Answer	Additional guidance	Mark
2 (b)	diminished/smaller (1) real (1)	 accept recognisable spellings e.g. reel do not credit not virtual	**2** **AO2.2**

Question number	Answer	Additional guidance	Mark
2 (c)	shorter / less / smaller (1) greater / larger / more / stronger (1)	lower higher	**2** **AO1.1**

Question number	Answer	Additional guidance	Mark
2 (d)	an explanation linking blurred / fuzzy/ distorted (1) rays are reflected in different directions / randomly (from mirror S) (1)	allow reverse arguments (reflection in mirror) S is diffuse allow light for rays (reflection in mirror) R is specular rays reflected from R are parallel	**2** **AO3.2**

Total for question 2 =7 marks

Question number	Answer	Additional guidance	Mark
3(a)	gravitational attraction	gravity gravitational field /force	**1** **AO1.1**

Question number	Answer	Additional guidance	Mark
3 (b)(i)	$\frac{10 \times 46}{(100)}$ (1) (time=) 4.6 (billion years) (1)	 accept 4 600 000 000 4.6×10^9 award one mark for power of ten error award one mark for answer of 5.4 or 5 400 000 000 or 5.4×10^9 (has found time remaining with no power of ten error) award full marks for the correct answer without working	**2** **AO2.1**

Question number	Answer	Additional guidance	Mark
3(b)(ii)	a description to include any **two** from {volume/ diameter/radius/ size} changes (1) (Sun becomes) a red giant (1) cools down (1) (eventually becomes) a white dwarf (1)	 ignore explode / implode do not accept red super giant / supernova lose heat (energy) accept black dwarf	**2 AO2.1**

Question number	Answer	Additional guidance	Mark
3(c)	description to include any **two** from: (two) isotopes/nuclei/atoms (1) fusing (1) release / emit energy (1) decrease in mass (1)	 hydrogen joining / coming together allow heat for energy	**2 AO1.1**

Question number	Answer	Additional guidance	Mark
3(d)	an explanation linking any **two** from (their) laboratory (equipment) is unlikely to be able to produce required conditions (1) need (very) high temperatures (1) need (very) high pressure (1) results had not been peer reviewed (1) no other scientist produced similar results (1)	 requires much more equipment than available in a typical laboratory high (particle) speed / KE high (particle) [density not checked by other scientists	**2** **AO3.3**

Total for question 3 = 9 marks

Question number	Answer	Additional guidance	Mark
4 (a)(i)	B 1s A is incorrect because this is before the driver reacts. C is incorrect because this is the braking time D is incorrect because 22 is a value of the initial velocity		**1** **AO2.1**

Question number	Answer	Additional guidance	Mark
4 (a)(ii)	Any **one** from • tiredness • distraction • drugs / alcohol • (old) age	accept similar descriptions any named drug	**1** **AO1.1**

Question number	Answer	Additional guidance	Mark
4 (a)(iii)	attempt to use the correct part of the graph (1) attempt to find area under graph(1) ½ x b x h evaluation (1) 33 (m)	values of 22(±0.5) and 4 or 22(±0.5) and 3 seen 0.5 x 4 x 22(±0.5) or 0.5 x 3 x 22(±0.5) accept values between 32 and 34 for 3 marks accept values between 43 and 45 for 2 marks accept values between 64.5 and	**3** **AO2.1**

		67.5 for 1 mark. accept values between 86 and 90 for 1 mark award full marks for the correct answer without working	

Question number	Answer	Additional guidance	Mark
4b	an explanation linking any **two** from shorter reaction time (of computer-controlled car) (1) shorter thinking distance (1)	allow reverse arguments computer (reaction time) not affected by other relevant factors shorter distance (travelled) **before brakes applied**	**2** **AO3.1**

Question number	Answer	Additional guidance	Mark
4(c)(i)	speed should be reduced (1)	slower accept specified numerical reduction e.g. from 40 to 20	**1** **AO3.1**

Question number	Answer	Additional guidance	Mark
4(c)(ii)	any **one** from friction (between wheel and road) is reduced (1) braking distance would be longer (on wet road) (1)	allow reverse argument idea that (road) more slippery / car could skid less traction	**1** **AO3.1**

	(overall) stopping distance would be longer (on wet road) (1)	longer (time/distance) to stop ignore crash / collision/ accident ignore changes to thinking distance	

Total for question 4 = 9 marks

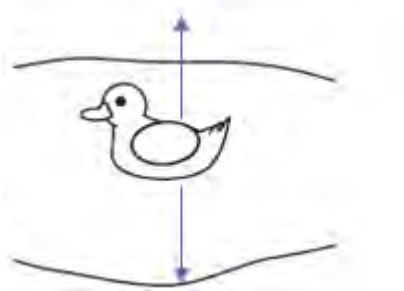
Question number	Answer	Additional guidance	Mark
5(a)	B A, C and D are incorrect because energy is transferred but air is not transferred		**1** **AO1.1**

Question number	Answer	Additional guidance	Mark
5(b)	A amplitude B, C and D are incorrect because they are independent of intensity		**1** **AO1.1**

Question number	Answer	Additional guidance	Mark
5(c)	substitution (1) 330 = f x 0.75 rearrangement (1) (f =) $\frac{330}{0.75}$ evaluation (1) (f =) 440 (Hz)	substitution and rearrangement may be in either order. f = $\frac{v}{\lambda}$ if no other marks scored then award 1 mark for an answer that rounds to 0.0023 or 250 award full marks for the correct answer without working	**3** **AO2.1**

Question number	Answer	Additional guidance	Mark
5(d)	A 9cm B is incorrect because amplitude is measured from zero to the peak displacement C is incorrect because this is half the wavelength D is incorrect because this is the wavelength.		**1** **AO2.1**

Question number	Answer	Additional guidance	Mark
5(e)(i)	a description to include: use (wave) speed = <u>distance</u> time (1) find relevant time (1) measure specified distance (1)	 use v = f x λ count number of waves in specified time width / radius / circumference of pond do not accept wavelength	**3** **AO2.2**

Question number	Answer	Additional guidance	Mark
5(e)(ii)	arrow(s) up and/or down (1) 	judge by eye need not be on duck do not credit answers that imply duck (also) moves horizontally	**1** **AO1.1**

Total for question 5 = 10 marks

Question number	Answer	Additional guidance	Mark
6(a)	X: electron (1) Y: neutron (1) Z: proton (1)	accept recognisable spellings. accept Y and Z in the wrong order for 1 mark independent of any mark for X	**3** **AO1.1**

Question number	Answer	Additional guidance	Mark
6(b)	D it does not change A, B and C are incorrect because the number of nucleons does not change in gamma emission		**1** **AO1.1**

Question number	Answer	Additional guidance	Mark
6(c)(i)	any **one** from: keep a safe distance (1) point the source away from people (1) handle the source with tongs/at a distance (1) limit exposure time/return source to store (asap) (1) use shielding (1) use of gloves / mask (1) protective clothing (1) wear a film badge/monitor (1)	(store in) lead-lined box use of screen PPE ignore goggles	**1** **AO1.2**

Question number	Answer	Additional guidance	Mark
6(c)(ii)	the activity varies (slightly) (1)	numbers / counts / results / measurements are different no pattern increases and decreases ignore random(ly)	**1 AO1.1**

Question number	Answer	Additional guidance	Mark
6(c)(iii)	21 (1)	$\frac{21+23+19+22}{4}$ or $\frac{85}{4}$ accept 21.3 or 21.2 or 21.25 do not accept 21.5 (median)	**1 AO3.2**

Question number	Answer	Additional guidance	Mark
6(d)(i)	an explanation linking any two from readings fall (to almost zero) (1) radiation is (all) absorbed (1) after a few cm (of air) (1)	 accept graph / activity / measurements for readings stopped by air in a short distance (in air) reverse arguments must include beta **and** gamma	**2 AO2.1**

Question number	Answer	Additional guidance	Mark
6(d)(ii)	background radiation (1)	or words to that effect accept named examples ignore reference to original alpha source	**1** **AO2.1**

Total for question 6 = 10 marks

Question number	Answer	Additional guidance	Mark
7 (a)(i)	 B A is incorrect because the force of gravity acts towards the centre C and D are incorrect because the force does not act tangentially		**1** **AO1.1**

Question number	Answer	Additional guidance	Mark
7 (a)(ii)	an explanation linking any **two** from velocity is changing (1) direction is changing (1) there is a resultant force (on the satellite) (1)	 velocity / acceleration is a vector accept unbalanced forces the direction of the velocity is changing scores 2 marks	**2** **AO1.1**

Question number	Answer	Additional guidance	Mark
7 (b)	an explanation linking any **two** from improves clarity (of images) (1) light (from distant objects) is (very) faint (1) idea that atmosphere absorbs/scatters light (1) (HST) is above the atmosphere (1) light pollution (on/from Earth) (1)	accept air for atmosphere	**2** **AO1.1**

Question number	Answer	Additional guidance	Mark
7 (c)	a description to include time (to complete orbit) increases as height increases (1) relationship is linear (1)	accept positive correlation accept reverse argument (can draw) a straight line (through the points) accept directly proportional in this context	**2** **AO3.1**

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. May be shown in a diagram. Objects • fixed stars are not part of solar system • additional planets are in solar system • these include Neptune and Uranus • asteroids / minor planets / comets are in solar system • planets have their own moons • the Sun is a star and is very much larger than the planets Arrangement of objects in Solar System • Earth not at the centre • Sun is in the centre • Earth between Venus and Mars • Moon (still) orbits Earth. • planets orbit the Sun. • asteroids / comets orbit Sun • orbits are not circular • (relative) distance between planets and Sun much larger • stars are very large distance from Solar System.	**6** **AO1.1** **AO3.1**

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 an explanation 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 an explanation 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 an explanation 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 Facts about either objects or arrangement	Possible candidate responses The Earth is not at the centre. There are additional planets
Level 2	3–4	Additional guidance Partially complete comparison of objects and arrangement	Possible candidate responses Earth is a planet. Neptune is another planet. All the planets orbit the Sun.
Level 3	5–6	Additional guidance Detailed comparison of objects and arrangement	Possible candidate responses All the planets including the Earth go round the Sun. The moon goes round the Earth. The stars are a long way from the Solar System and are not part of it.

Question number	Answer	Additional guidance	Mark
8 (a)	Substitution or rearrangement (1) 980 = 35 x 10 x h evaluation (1) (h =) 2.8 (m)	(Δh =) $\frac{\Delta GPE}{m \times g}$ or (Δh =) $\frac{980}{35 \times 10}$ allow use of 9.8 N/kg or 9.81 N/kg allow substitution into visible incorrectly rearranged algebraic expression allow 2.85/2.86/2.9 for use of g = 9.8 N/kg or 9.81 N/kg ignore use of negative for decrease in GPE award full marks for the correct answer without working	**2** **AO2.1**

Question number	Answer	Additional guidance	Mark
8 (b)	substitution (1) $(v^2) = \frac{950 \times 2}{35}$ evaluation of v^2 (1) 54(.29) evaluation of v (1) (v =) 7.4 (m/s)	accept values that round to 7.3(m/s) or 7.4(m/s) accept answer of 7 (one sig. fig.) award 2 marks for an answer that rounds to 54 (m/s) if no other mark scored allow 1 mark for an answer that rounds to 0.23 (m/s) (use of mass in g) award full marks for correct answer without working	**3** **AO2.1**

Question number	Answer	Additional guidance	Mark
8(c)(i)	thermal (energy/store) (1)	energy dissipated energy wasted energy lost energy transferred to surroundings energy transferred due to friction energy transferred due to air resistance allow heat (energy) ignore sound/not useful energy	**1** **AO2.1**

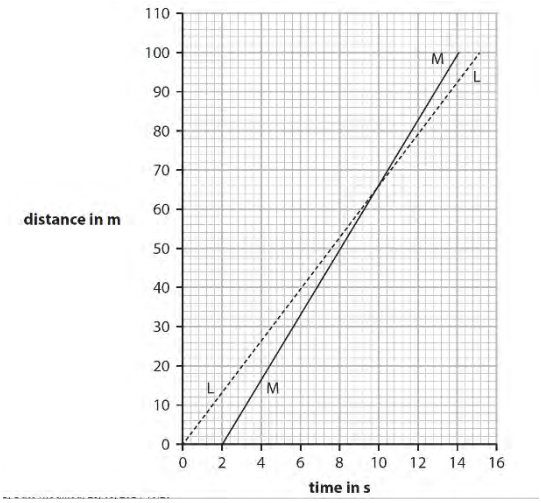
Question number	Answer	Additional guidance	Mark
8 (c)(ii)	30 (J) (1)	accept -30	**1** **AO2.1**

Question number	Answer	Additional guidance	Mark
8 (c)(iii)	substitution (1) 950 (x100) 980 evaluation (1) 0.97 OR 97%	 allow answers that round to 0.97 or 97% for 2 marks allow 1 mark for answers that round to 97 or 0.97% allow 1 mark for answers of 0.96 or 96% (truncated) award full marks for correct answer without working	**2 AO2.1**

Question number	Answer	Additional guidance	Mark
8 (d)	any **two** from reduce air resistance (1) lubricate (wheels) (1) push off (1)	 be more aerodynamic crouch down	**2** **AO1.1**

Total for question 8 = 11 marks

Question number	Answer	Additional guidance	Mark
9 (a)(i)	66 (m)	allow values between 64 and 68 inclusive allow values between 32 and 36 as the distance L has to run after M overtakes in this context	**1 AO3.2**

Question number	Answer	Additional guidance	Mark
9 (a)(ii)	select (1) $v = \frac{x}{t}$	allow any identifiable distance from graph divided by any identifiable time from graph e.g. $\frac{100}{15.2}$  	**2 AO2.1**
	evaluation (1) 6.6 (m/s)	allow values that round to between 6.5 (m/s) and 6.7 (m/s) for example 6.666 (m/s) or 6.579 (m/s) award full marks for correct answer without working	

Question number	Answer	Additional guidance	Mark
9 (b)(i)	substitution (1) (t =) $\frac{10 - 6.2}{2.5}$ evaluation (1) (t =) 1.5 (s)	 $\frac{3.8}{2.5}$ allow $\frac{6.2 - 10}{2.5}$ or $\frac{-3.8}{2.5}$ 1.52 (s) allow –1.5(2) (s) award full marks for correct answer without working	**2** **AO2.1**

Question number	Answer	Additional guidance	Mark
9 (b)(ii)	substitution OR rearrangement (1) $(-)10^2 = 2 \times (-)\ 4.4 \times x$ evaluation (1) (x =) 11 (m)	 $(x) = \frac{v^2 - u^2}{2 \times a}$ $(x=)\ \frac{(-)10^2}{2 \times (-)\ 4.4}$ allow values that round to 11 (m) e.g. 11.36 (m) ignore negative sign in answer line	**2** **AO2.1**

		accept 1.1(36) for one mark award full marks for correct answer without working	

Question number	Indicative content	Mark
***9(c)**	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. **measurement of distance using a rule or similar to find** • height of the ramp • travelled length of ramp / distance x to Y • width of card (if used) • distance between light gates (if used) • distance between dots on tape (if used) **measurement of time such as** • use of ticker-tape • use of a single light gate connected to electronic timer with a card fixed to the trolley • use of two light gates connected to electronic timer with a means of interrupting the light beams • use of (manually operated) stop clock /watch / timer	**6** **AO1.2**

	determination of speed • detail about which distance and time measurements are being used • repeat and average • repeat using different heights of the ramp	

Level	Mark	Descriptor
	0	• No rewardable material.
Level 1	1-2	• Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific, enquiry, techniques and procedures lacks detail. (AO1) • Presents a description which is not logically ordered and with significant gaps. (AO1)
Level 2	3-4	• Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas, enquiry, techniques and procedures is not fully detailed and/or developed. (AO1) • Presents a description of the procedure that has a structure which is mostly clear, coherent and logical with minor steps missing. (AO1)
Level 3	5-6	• Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas, enquiry, techniques and procedures 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 Limited description of measurement of distance and time	Possible candidate responses Measure the distance down the ramp. determine the time it took.
Level 2	3–4	Additional guidance Partial description including **two** from measurement of a relevant distance measurement of relevant time calculation of speed	Possible candidate responses Use the light gates to measure the time it took to go down. Measure the distance down the ramp with a ruler.
Level 3	5–6	Additional guidance Detailed description of measurements of relevant distances and associated times to find speed	Possible candidate responses Use light gates to measure the time to go from X to Y Use a ruler to measure the distance between the light gates. Divide distance between the light gates by the time taken to travel from X to Y.

Total for question 9 = 13 marks

Question	Answer	Mark
10 (a)	**A** gamma rays **B** X-rays, **C** ultraviolet, **D** microwaves, all applied externally	**1** **AO1.1**

Question	Answer	Additional guidance	Mark
10(b)(i)	an explanation linking any 3 from positrons and electrons annihilate (1) (two) gamma rays produced/emitted (1) in opposite directions /at 180° (1) detected by radiation detector/ gamma cameras/scintillation counters (1) at (almost) the same time (1) time difference gives distance difference (1)	ignore positrons for this marking point allow triangulation	**3** **AO2.2**

Question	Answer	Additional guidance	Mark
10(b)(ii)	an explanation linking any two from must be used a short time after production (1) half-life is short (1)	must be used while activity is high	**2** **AO1.2**

	activity decreases rapidly/decays rapidly (1)	accept decays before use / does not last long	

Question	Answer	Additional guidance	Mark
10 (c)	any two from irradiation does not make an object radioactive (1) irradiation can be stopped by shielding (1) irradiation source is outside the object (1) irradiation stops when the source is removed (1)	 ORA ORA source of contamination is in or on the object effect of contamination is continuous allow you can move away from irradiation	**2** **AO1.1**

Question	Answer	Additional guidance	Mark
10(d)(i)	correct use of the graph (1) 110 to 130 (hours) inclusive (1)	horizontal line in range 48-52 Bq to line for either isotope allow two horizontal lines showing halving of the activity award full marks for the correct answer without working	**2** **AO2.1**

Question	Answer	Additional guidance	Mark
10 (d)(ii)	**one** suggestion from: (Q) has longer half-life (1) (Q) does not decay as quickly/ takes longer to decay (1) (Q) (maintains) a higher (level of) activity (1) (Q) gives a higher <u>dose</u> (1) (Q) emits more ionising (type of) radiation (1)	allow reverse arguments activity decreases more slowly (always) more (radio)active / more decays per second	**1 AO2.2**

Total for question 10 = 11 marks

Total for paper = 100 marks