



Mark Scheme (Results)

Pearson Edexcel

Additional Sample Assessment
Materials GCSE 9-1
Paper 1: Physics 1PH0/1H

First examination 2017

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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.

Paper 1 Higher Physics SAM Set 2

Question number	Answer	Mark
1(a)(i)	Any three of <ul style="list-style-type: none"> • sound waves are longitudinal but radio waves are transverse. • sound waves need a medium but radio waves travel through a vacuum. • sound waves have (much) lower velocity than radio waves. • sound waves have lower frequency / greater wavelength than radio waves • sound waves are vibrations but radio waves are electromagnetic waves. 	(3)

Question number	Answer	Additional guidance	Mark
1(b)	D a TV remote control		(1)

Question number	Answer	Additional guidance	Mark
1(c)	An answer that combines the following points of understanding to provide a logical description: <ul style="list-style-type: none"> • radio waves will not reach the satellites (from Earth) / be received (on Earth) from the satellites (1) • because they are reflected by the atmosphere (1) 	ORA for microwaves reflected by ionosphere / before reaching satellite	(2)

Question number	Answer	Mark
1(d)	An answer that combines 2 points of understanding to provide a logical description: <ul style="list-style-type: none"> • Discovery of cosmic background microwave radiation (1) • Could be explained as resulting from Big Bang (1) • Could not be explained by steady state theory (1) 	(2)

Total for question 1 = 8 marks

Question number	Answer	Mark
2(a)	B 10^{-10} m	(1)

Question number	Answer	Mark
2(b)	<p>one from</p> <ul style="list-style-type: none"> • same atomic number (1) • same number of protons (1) • same element (1) <p>and one from</p> <ul style="list-style-type: none"> • different numbers of neutrons (1) • different mass numbers (1) 	(2)

Question number	Answer	Additional guidance	Mark
2(c)	<p>An explanation that combines understanding (1 mark) and reasoning (1 mark) linking:</p> <ul style="list-style-type: none"> • number of neutrons decreases by one (1) • number of protons increases by one.(1) 	a neutron becomes a proton plus an electron for (2) marks	(2)

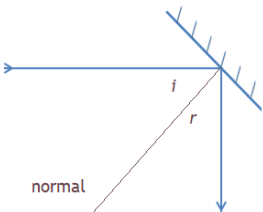
Question number	Answer	Mark
2(d)	C a helium nucleus	(1)

Question number	Indicative content	Mark
2(e)	<p>An explanation that combines identification via a judgment (2 marks) to reach a conclusion via justification/reasoning (1 mark):</p> <ul style="list-style-type: none"> • some alpha particles go straight through (1) • some alpha particles scattered (1) • idea of all mass / (positive) charge concentrated in centre /nucleus (1) • mainly empty space (in rest of atom) (1) 	(3)

Total for question 2 = 9 marks

Question number	Answer	Mark
3(a)	An answer that provides a description by making reference to: <ul style="list-style-type: none"> leaf appears black (1) background appears blue (1) 	(2)

Question number	Answer	Additional guidance	Mark
3(b)	An explanation that combines application of knowledge (1 mark) and reasoning (1 mark) linking: <ul style="list-style-type: none"> (faces of) people are at a higher temperature than the background (1) therefore they emit more (infrared) at shorter wavelengths than background (1) 	accept higher frequency / higher intensity	(2)

Question number	Answer	Additional guidance	Mark
3(c) (i)	<ul style="list-style-type: none"> normal drawn correctly (1) angles of incidence and reflection shown correctly (1) 		(2)

Question number	Answer	Additional guidance	Mark
3(c) (ii)	The critical angle must be less than 45° (1)		(1)

Question number	Answer	Acceptable answer	Mark
3(ciii)	A reason which links <ul style="list-style-type: none"> Total internal reflection in the prism(s) (1) No light is scattered (1) 	No light is lost / no multiple reflections	(2)

Total for question 3 = 9 marks

Question number	Answer	Additional guidance	Mark
4(a)(i)	0.45 (s) (1)	Allow any value ≥ 0.4 and ≤ 0.5	(1)

Question number	Answer	Additional guidance	Mark
4(a)(ii)	<p>An explanation that combines improvement of the experimental procedure (1 mark) and justification/reasoning which must be linked to the improvement (1 mark)</p> <ul style="list-style-type: none"> take pictures more frequently (1) in order to determine exact time of the release. (1) 	other responses may be acceptable	(2)

Question number	Answer	Additional guidance	Mark
4(a)(iii)	<p>Substitution (1) $F = 7.26 \times 20.6$</p> <p>Evaluation (1) 150 (N)</p>	<p>Accept 149.6 (N)</p> <p>full marks will be awarded for correct numerical answer without working</p>	(2)

Question number	Answer	Additional guidance	Mark
4(a)(iv)	<p>Rearrangement (1) $v = a \times t$</p> <p>Substitution (1) $v = 23 \times 0.48$</p> <p>Evaluation (1) 11 m/s</p>	<p>Accept 11.04(m/s)</p> <p>full marks will be awarded for correct numerical answer without working</p>	(3)

Question number	Answer	Additional guidance	Mark
4(b)	Substitution (1) $PE = 7.26 \times 10 \times 1.3$ Evaluation (1) 94.4 (J)		(2)

Question number	Answer	Additional guidance	Mark
4(c)	An explanation that combines up to 3 points of application of knowledge and reasoning/justification <ul style="list-style-type: none"> • Momentum increased if final velocity can be increased (1) • Distance (while in athlete's hand) is greater (1) • Time whilst subject to force is longer (1) • using the equation $F = (mv - mu)/t$ (1) 	Ignore references to shot after it has left the athletes hand accelerating for a longer time use of $v = u + at$ or use of $v^2 - u^2 = 2ax$	(3)

Total for question 4 = 13 marks

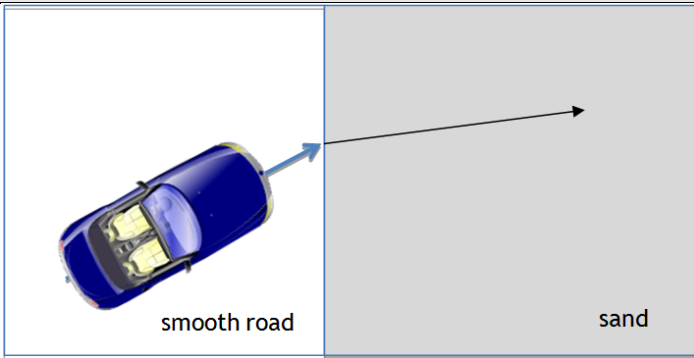
Question number	Answer	Mark
5(a)	B neutron	(1)

Question number	Answer	Additional guidance	Mark
5(b)	<p>An explanation that combines understanding (1 mark) and reasoning/justification - understanding (2 marks):</p> <ul style="list-style-type: none"> • slows down neutrons (1) • increase chance of collision / fission (1) • maintain the reaction rate (1) 	<p>to allow capture by nucleus</p> <p>increase the reaction rate</p>	(3)

Question number	Answer	Additional guidance	Mark
5(c)	<p>An answer that provides a description by making reference to:</p> <ul style="list-style-type: none"> • (energy used to) create steam (1) • steam drives a turbine (1) 		(2)

Question number	Answer	Additional guidance	Mark
5(d)	<p>An explanation that makes reference to identification - knowledge (2 marks) and reasoning/justification - knowledge (1 mark):</p> <ul style="list-style-type: none"> • fusion requires high temperatures and pressures (1) • (in order to overcome) electrostatic repulsion of nuclei (1) • (we are currently) unable to maintain these conditions (in a commercial reactor) (1) 		(3)

Total for question 5 = 9 marks

Question number	Answer	Mark
6(a)(i)	 <p>approx</p>	(1)

Question number	Answer	Additional guidance	Mark
6(a)(ii)	<p>An explanation that combines identification - knowledge (1 mark) and reasoning/justification - understanding (1 mark):</p> <ul style="list-style-type: none"> both car and light ray slow down when entering sand / glass (1) direction changes towards normal (1) 	Bend towards the normal	(2)

Question number	Answer	Acceptable	Mark
6(b)(i)	<p>An explanation that combines identification - understanding (1 mark) and reasoning/justification - understanding (2 marks):</p> <ul style="list-style-type: none"> white light is a mixture of different wavelengths (1) each wavelength / colour is refracted by a different amount (1) short <u>wavelengths</u> are refracted more / ORA (1) 	ignore colours	(3)

Question number	Answer	Acceptable	Mark
6(b)(ii)	<p>An answer that combines the following points to provide a logical description of the method:</p> <ul style="list-style-type: none"> • Place a thermometer (with blackened bulb) beyond position of red light (1) • Look for rise in temperature (measured by thermometer) (1) 		(2)

Total for question 6 = 8 marks

Question number	Answer	Additional guidance	Mark
7 (a) (i)	<p>An explanation that combines identification - knowledge (1 mark) and reasoning/justification - understanding (1 mark):</p> <ul style="list-style-type: none"> unbalanced / resultant force (1) (provided by) tension in the string / (weight of) metal disc (1) 		(2)

Question number	Answer	Additional guidance	Mark
7 (a) (ii)	<p>substitution into speed = d/t (1)</p> $1.15 = d / 0.04 \quad (1)$ <p>evaluation (1)</p> $d = 0.046\text{m}$ $= 4.6 \text{ cm} \quad (1)$	full marks will be awarded for correct numerical answer without working	(2)

Question number	Answer	Additional guidance	Mark
7 (a) (iii)	<p>using $V^2 - u^2 = 2ax$</p> $V^2 = 1.15^2$ $= 1.3225 \quad (1)$ $2 \times a \times x = 2 \times 1.2 \times 0.55$ $= 1.32 \quad (1)$	allow 1.3225	(2)

Question number	Answer	Additional guidance	Mark
7 (b) (i)	4.4 m/s^2		(1)

Question number	Answer	Additional guidance	Mark
7 (b) (ii)	<p>graph (if projected back) does not pass through origin OWTTE (1)</p>	accept not a straight line	(1)

Question number	Answer	Additional guidance	Mark
7 (b) (iii)	<p>An answer that combines the following points to provide a plan/method:</p> <ul style="list-style-type: none"> • raise left hand end of runway (1) • (so that) force of gravity on trolley will balance frictional forces (1) 	(so that) trolley travels at constant speed when given a small push	(2)

Total for question 7 = 10 marks

Question Number	Answer	Mark
8(a) (i)	B all four dolphins emit ultrasound	(1)

Question Number	Answer	Additional guidance	Mark
8 (a) (ii)	<p>calculation including conversion of lower frequency into kHz 120 – 0.1 (1)</p> <p>evaluation of range 119.9 (kHz) (1)</p>	<p>allow 1 mark for evaluation arising from failure to correctly convert Hz into kHz (e.g. 119 kHz)</p> <p>full marks will be awarded for correct numerical answer without working</p>	(2)

Question Number	Answer	Additional guidance	Mark
8 (b)	<p>an answer that provides a description by making reference to:</p> <ul style="list-style-type: none"> the frequency is lower (1) the wavelength is longer (1) 	<p>award one mark for doppler shift if no other mark is awarded</p>	(2)

Question Number	Answer	Additional guidance	Mark
8 (c)	<p>An answer that combines the following points of understanding to provide a logical description:</p> <ul style="list-style-type: none"> • (dolphin emits and) receives sound reflected from the objects (1) • (dolphin determines) difference in times taken to receive the echo (1) • sound received in a shorter time from nearer object (1) 	may be inferred from a diagram	(3)

Question number	Answer	Acceptable	Mark
8(d)	<p>substitution (1) $1530 = (1.2/1000) \times \text{wavelength}$</p> <p>rearrangement (1) $\text{wavelength} = 1530 / (1.2/1000)$</p> <p>evaluation (1) $= 1.275 \text{ (m)}$</p>	<p>2 marks for 1275m (incorrect conversion into Hz)</p> <p>full marks will be awarded for correct numerical answer without working</p>	(3)

Total for question 8 = 11 marks

Question number	Answer	Additional guidance	Mark
9(a)	<p>An answer that combines the following points of application of knowledge and understanding to provide a logical description:</p> <ul style="list-style-type: none"> • start the clock when the Sun is at the highest point (1) • finish the clock when the Sun is at the highest point again (1) 	Shadow is shortest	(2)

Question number	Answer	Additional guidance	Mark
9(b)	<p>$v = \frac{2 \times \pi \times R}{T}$</p> <p>unit conversion (1) $10^8 \text{ km} = 10^{11} \text{ m}$</p> <p>substitution (1)</p> <p>$v = \frac{2 \times \pi \times 1.5 \times 10^{11}}{3.2 \times 10^7}$</p> <p>evaluation (1) $v = 2.9 \times 10^4 \text{ (m/s)}$</p>	<p>Allow values which round to 2.9×10^4</p> <p>full marks will be awarded for correct numerical answer without working</p>	(3)

Question number	Indicative content		Mark
9 (c) *	<p>Answers will be credited according to the candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>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.</p> <p style="text-align: center;">A01 (6 marks)</p> <ul style="list-style-type: none"> • Gravity is an attractive force • Gravity pulls stellar matter inwards • Fusion reactions in the core release thermal energy • Thermal energy gives rise to expansion force • Sun is (currently) stable because these two forces are in equilibrium • Mass of Sun is important factor • Red supergiants explode in supernova • Sun does not have enough mass to be a red supergiant 		(6)
Level	Mark	Descriptor	
	0	No rewardable material.	
Level 1	1–2	<ul style="list-style-type: none"> • Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of science ideas lacks detail (A01) • Presents an explanation with some structure and coherence (A01) 	
Level 2	3–4	<ul style="list-style-type: none"> • Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (A01) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (A01) 	
Level 3	5–6	<ul style="list-style-type: none"> • Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (A01) • Presents an explanation that has a well-developed structure which is clear, coherent and logical. (A01) 	

Total for question 9 = 11 marks

Question number	Answer	Additional guidance	Mark
10(a)(i)	substitution (1) $371 = (64.5 + m) \times 3.5$ rearrangement (1) $m + 64.5 = 371 / 3.5$ evaluation of total mass (1) $m + 64.5 = 106 \text{ (kg)}$ evaluation of woman's mass (1) $m = 106 - 64.5$ $= 41.5 \text{ (kg)}$	 full marks will be awarded for correct numerical answer without working	(4)

Question number	Answer	Additional guidance	Mark
10(a)(ii)	substitution (1) $KE = \frac{1}{2} \times 64.5 \times 3.5^2$ evaluation (1) 395 (J)	allow answers which round to 395 e.g. 395.0625 full marks will be awarded for correct numerical answer without working	(2)

Question number	Indicative content	Mark
10 (b) *	<p>The indicative content below is not prescriptive and candidates are not required to include all of the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p style="text-align: center;">A01 (6 marks)</p> <ul style="list-style-type: none"> • force needed to keep an object moving in a circle • when moving in a circle, direction of velocity changes • must be an acceleration • moving in a straight line with no resultant force at constant velocity <p style="text-align: center;">A02 (6 marks)</p> <ul style="list-style-type: none"> • the woman changing direction while circling the man • she is changing velocity (but not changing speed) • therefore she is accelerating • this requires a force towards the centre of her orbit • this is a centripetal force • when the man releases the woman, the centripetal force ceases • there is no resultant force on the woman (if friction from the ice can be ignored) • the woman therefore continue in a straight line • she is now travelling at a constant velocity 	(6)

Level	Mark	Descriptor
	0	No awardable content
Level 1	1-2	<ul style="list-style-type: none"> • Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • 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	<ul style="list-style-type: none"> • Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • 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	<ul style="list-style-type: none"> • Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • 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)

Total for question 10 = 12 marks

