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Mark Scheme (Results)

November 2020

Pearson Edexcel International GCSE In Physics (4PH1) Paper 1PR

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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.

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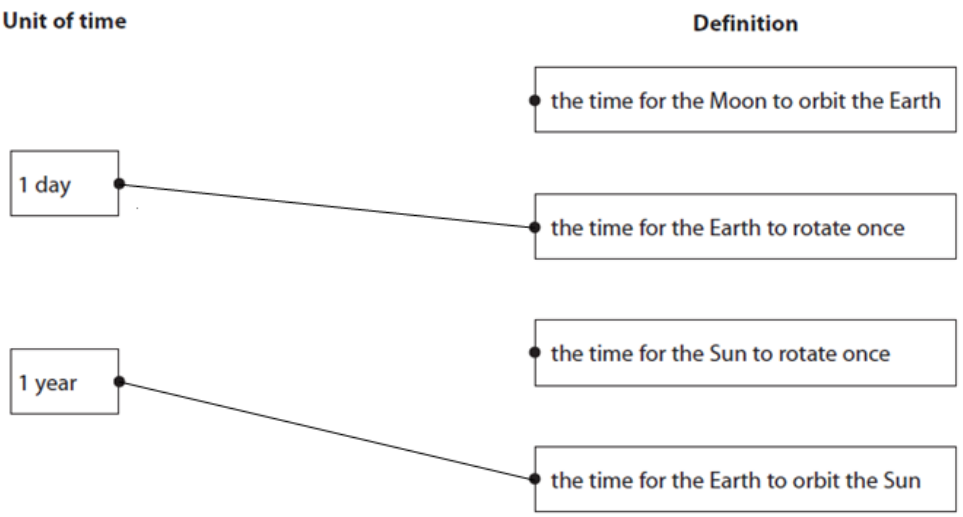
Question number	Answer	Notes	Marks
1 (a)	Universe; galaxy Solar System;	 allow named galaxy e.g. Milky Way	3
(b) (i)	A; B is incorrect because it is further from the Sun and speed decreases with distance C is incorrect because it is further from the Sun and speed decreases with distance D is incorrect because it is further from the Sun and speed decreases with distance		1
(ii)	gravity;	allow gravitational force, gravitational pull reject gravitational potential, gravitational field strength, *g*	1
(c)	one mark for each correct line;;  	-1 for each additional line	2

Total for Question 1 = 7 marks

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<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>2 (a)</td><td>all three correct ticks = 3 marks;;;
two correct ticks = 2 marks;;
one correct tick = 1 mark;

<table><tr><th>Statement</th><th>Correct (✓)</th></tr><tr><td>uranium-235 loses a proton to become uranium-236</td><td></td></tr><tr><td>uranium-235 absorbs a neutron to become uranium-236</td><td>✓</td></tr><tr><td>daughter cells are produced when uranium-236 splits</td><td></td></tr><tr><td>the nuclear energy store of uranium-236 increases when it splits</td><td></td></tr><tr><td>two or three neutrons are typically released when uranium-236 splits</td><td>✓</td></tr><tr><td>energy is transferred to the kinetic store of the fission products when uranium-236 splits</td><td>✓</td></tr></table></td><td>-1 for 4 ticks
-2 for 5 ticks
0 marks if all ticked</td><td>3</td></tr>
<tr><td>(b)</td><td>neutron / n / neutrons;</td><td></td><td>1</td></tr>
<tr><td>(c)</td><td>B (a helium nucleus);

A is incorrect because this describes gamma radiation
C is incorrect because this describes beta radiation
D is incorrect because this describes neutron radiation</td><td></td><td>1</td></tr>
<tr><td>(d)</td><td>beta (minus);</td><td>accept β, β^-
reject beta plus</td><td>1</td></tr>
</table>

Total for Question 2 = 6 marks

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Question number	Answer	Notes	Marks
3 (a) (i)	(average) speed = distance / time;	allow standard symbols and rearrangements e.g. v = s/t allow s for speed and d for distance	1
(ii)	substitution; evaluation; e.g. (speed =) 1860 / 5.6 (speed =) 330(m/s)	 allow 332.14…(m/s)	2
(iii)	light travels faster than sound; he sees explosion before hearing it;	allow idea that they travel at different speeds but not that sound travels faster Allow RA	2
(b)	vibrations (of particles) are parallel; to direction the wave travels;	allow oscillations for vibrations DOP allow direction of energy transfer	2
(c) (i)	kinetic energy = ½ × mass × speed^2;	allow standard symbols and rearrangements e.g. KE = ½ × m × v^2	1
(ii)	substitution; evaluation; e.g. (KE =) $0.5 \times 1.25 \times 10^7 \times 19200^2$ (KE =) 2.30×10^{15} (J)	 -1 for POT error allow 2.304×10^{15} (J)	2

Total for Question 3 = 10 marks

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Question number	Answer	Notes	Marks
4 (a)	A (blue-white); B is incorrect because orange stars are cooler than blue-white stars C is incorrect because red stars are cooler than blue-white stars D is incorrect because yellow stars are cooler than blue-white stars		1
(b)	any two from: gas collapses / gas particles attract each other; temperature (of the gas) increases; fusion **starts**/eq;	 condone 'dust' for 'gas' allow particles increase in <u>K</u>E	2
(c)	two (small) **nuclei**; join together (to produce a large nucleus); releasing energy;	 allow gamma radiation	3
(d) (i)	C (mass); A is incorrect because colour is determined by the surface temperature B is incorrect because distance determines its apparent brightness D is incorrect because temperature determines the spectral class		1
(ii)	any three from: MP1. Rigel will become a red supergiant; MP2. then contracts rapidly; MP3. (explodes as a supernova) leaving a neutron star; MP4. (or) black hole;		3

Total for Question 4 = 10 marks

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Question number	Answer	Notes	Marks
5 (a)	wires have a higher current / voltage;	allow idea that if one breaks the rest will keep working / some can be on but not others / eq	1
(b) (i)	power = current × voltage;	allow standard symbols and rearrangements e.g. $P = I \times V$ reject C for current, W for power	1
(ii)	substitution; rearrangement; evaluation; e.g. 2800 = current × 230 (current =) 2800 / 230 (current =) 12 (A)	 in either order -1 for POT error allow 12.17…(A)	3
(iii)	(current = 12 / 48 =) 0.25 (A)	allow ecf from (ii)	1

Total for Question 5 = 6 marks

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Question number	Answer	Notes	Marks
6 (a)	using a balance; suitable method to subtract mass of container;	ignore weighing scales / scales e.g. • measure mass of similar empty container and subtract • place another container on balance and press zero then pour liquid into this container	2
(b)	any two from: MP1. measuring cylinder placed on horizontal surface; MP2. reading taken from bottom of meniscus/eq; MP3. reading taken at eye level (to avoid parallax); MP4. wait for all liquid to run down the sides of the measuring cylinder; MP5. ensure measuring cylinder is empty before use;	ignore idea of 'repeat and average' condone 'flat surface'	2
(c)	use of density formula; evaluation of density of liquid; liquid is sunflower oil; e.g. density = 150 / 163 density = 0.92 (g/cm^3) closest to sunflower oil => liquid is sunflower oil	unsupported correct conclusion scores 1 mark only	3

Total for Question 6 = 7 marks

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Question number	Answer	Notes	Marks
7	any six from: MP1. cat X loses more energy by conduction / convection than cat Y; MP2. cat Y loses more energy by radiation than cat X; MP3. fur traps air; MP4. larger surface area increases conduction (losses); MP5. air is a (good) insulator/ poor conductor; MP6. fur is a (good) insulator / poor conductor; MP7. trapped air cannot move around; MP8. trapped air reduces convection; MP9. black surfaces are better emitters / emit radiation faster;	allow RA throughout ignore black surfaces being better absorbers	6

Total for Question 7 = 6 marks

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Question number	Answer	Notes	Marks
8 (a)	take repeats and find the mean;	allow 'average' for 'mean'	1
(b)	any two from: MP1. mass (being lifted); MP2. height (lifted) / distance; MP3. power supply / circuit being used; MP4. temperature (of motor);	ignore 'same motor' condone weight	2
(c)	conversion of cm to m; substitution into GPE = mass × *g* × height; e.g. 50 cm = 0.5 m GPE = 1 × 10 × 0.5 (= 5 J)	 allow 0.5 seen anywhere allow use of *g* = 9.8(1) (m/s^2)	2
(d) (i)	efficiency formula seen; substitution; evaluation; e.g. efficiency = useful energy output / total energy input efficiency = 5 / 12.7 (×100%) efficiency = 39.4 (%)	 ignore s.f. allow 39, 39.37… reject unsupported incorrect answer	3
(ii)	suitable linear scale chosen (>50% of grid used); axes labelled with quantities and unit; all plotting correct to nearest half square;	ignore orientation ignore plotting at 10V	3
(iii)	acceptable curve of best fit drawn up to a voltage of 6V; straight horizontal line of best fit drawn from 6V onwards;	i.e. curved line with even distribution of points either side by eye	2
(iv)	correctly read voltage from graph consistent with candidate's curve of best fit;	allow range 5.4V – 6.6V allow ecf from (iii)	1

Total for Question 8 = 14 marks

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Question number	Answer	Notes	Marks
9 (a)	correct voltmeter symbol; voltmeter connected in parallel with resistor;		2
(b)	light dependent resistor;	allow LDR	1
(c) (i)	9(.0) (V);		1
(ii)	substitution OR rearrangement; evaluation; e.g. 9.0 = current × 4500 OR current = voltage / resistance (current =) 0.0020 (A)	allow ecf from (i) allow 0.002 (A)	2
(iii)	substitution OR rearrangement; evaluation in Ω; conversion to kΩ; e.g. 3.0 = 0.0020 × resistance OR resistance = voltage / current (resistance =) 1500 (Ω) (resistance =) 1.5 (kΩ)	allow ecf from (ii)	3
(d)	lamp should be connected in parallel with component X / LDR; resistance of component X increases when it gets dark; voltage across component X increases / becomes greater than 10V when it gets dark;		3

Total for Question 9 = 12 marks

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Question number	Answer	Notes	Marks
10 (a)	method to show shape; e.g. use compass(es) use of iron filings/powder use of plotting compass **to show direction**; a further method detail; e.g. mark card/move compass/multiple compasses idea of another line or lines added sprinkle (iron filings) tap card (to distribute iron filings)	all marks may be awarded from a labelled diagram	3
(b) (i)	any four from: MP1. idea that core **gains** a magnetic field; MP2. idea of a changing magnetic field; MP3. idea that field lines cut by wire; MP4. voltage induced (across coil); MP5. (causing a) current in the wire;	allow higher level ideas in terms of flux and flux linkage	4
(ii)	any one from: MP1. idea that dynamo-wheel friction makes bicycle harder to pedal; MP2. idea that lights would vary in brightness; MP3. lights will be off when bicycle is stationary;	allow current / brightness of lamps depends on how fast bicycle is moving	1

Total for Question 10 = 8 marks

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Question number	Answer	Notes	Marks
11 (a)	value of braking distance correctly read from graph; substitution into $v^2 = u^2 + 2as$; rearrangement; evaluation; e.g. braking distance = 78 m $0 = 35^2 + (2 \times a \times 78)$ (a =) (-) $35^2 / (2 \times 78)$ (a =) (-) 7.9 (m/s^2)	allow 77-79 m allow ecf incorrect distance allow 7.75… - 7.95…(m/s^2)	4
(b)	any five from: MP1. thinking distance OR braking distance increases as (initial) speed increases; MP2. braking distance increases by a greater amount than thinking distance for the same increase in (initial) speed; MP3. thinking distance is (directly) proportional to (initial) speed; MP4. braking distance has a non-linear relationship with (initial) speed; MP5. idea that braking distance is proportional to (initial) speed squared; MP6. suitable use of data to justify thinking distance relationship; MP7. suitable use of data to justify braking distance relationship;	 e.g. gradient of braking distance graph larger than gradient for thinking distance e.g. when initial speed doubles, the braking distance is four times greater / eq. e.g. reading off thinking distance for two values of initial speed and showing they increase by the same factor e.g. reading off braking distance for two values of initial speed and showing they do not increase by the same factor	5

Total for Question 11 = 9 marks

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Question number	Answer	Notes	Marks
12 (a) (i)	47 (°);		1
(ii)	sin(c) = 1 / n;		1
(iii)	substitution OR rearrangement; evaluation; e.g. sin(47) = 1/n OR n = 1/sin(c) (n =) 1.4	allow ecf from (i) answer is 1.37 to 3sf if (i) is given as 43° then expected answer is 1.5 to 2sf /1.47 to 3 sf	2
(b)	ray is refracting / angle of incidence is less than critical angle; critical angle for water is greater than for acetone; refractive index of water is less than for acetone;	award full marks for a correct calculation of the refractive index of water with correct conclusion e.g. $n_{water} = 1.33 < n_{acetone}$ Allow correct conclusion with $n_{water} = 0.75...$ for 1 mark MAX reject response with otherwise incorrect calculation of n_{water}	3

Total for Question 12 = 7 marks

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Question number	Answer	Notes	Marks
13 (a) (i)	358 (K);		1
(ii)	idea that speed / KE increases; **mean** speed / **mean** KE increases;	 allow average for mean	2
(iii)	number of molecules decreases;	however expressed	1
(b)	any four from: MP1. air in flask cools; MP2. molecules in flask slow down/<u>kinetic</u> energy of molecules reduces; MP3. pressure inside flask decreases (as temperature decreases); MP4. pressure outside flask greater than inside/eq; MP5. resultant force (from air) pushes egg down the neck of the flask; MP6. volume of air in flask decreases as the egg moves down; MP7. (so) pressure inside flask increases (as volume decreases); MP8. (eventually) pressure inside and outside balance; MP9. (so) resultant force is now zero (so egg stops moving down);	 allow 'stretches egg' allow higher level arguments including weight of egg, friction with neck, etc	4

Total for Question 13 = 8 marks

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