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Mark Scheme (Results)

January 2020

Pearson Edexcel International GCSE
in Physics (4PH1)
Paper 1P

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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	north; steel; hard; north; soft;	this order only	5

Total for Question 1 = 5 marks

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Question number	Answer	Notes	Marks
2 (a) (i)	downward arrow labelled weight; downward arrow is equal in length to upthrust arrow;	ignore starting point of arrow allow 'gravitational force', 'force due to gravity' reject 'gravity' judge by eye	2
(ii)	(a quantity with) magnitude; and direction;	allow size, amount ignore quantity, measurement	2
(iii)	any correct vector; e.g. velocity, displacement, acceleration, momentum etc.	ignore force, any named force e.g. weight, upthrust etc	1
(b) (i)	pressure (difference) = height $\times$ density $\times$ g;	allow standard symbols and rearrangements e.g. $p = h \times \rho \times g$ allow d for density ignore "gravity" for g	1
(ii)	substitution; evaluation of pressure difference in Pa OR kPa to at least 3s.f.; addition of surface pressure (100 kPa) to give answer; e.g. $p = 15.8 \times 1030 \times 10$ $p = 162740$ Pa OR 162.74 kPa $p = 162.74 + 100$ (= 260 kPa)	allow g = 9.8, 9.81 -1 for POT error unless due to physics error reject this mark if inconsistent units used allow final answer in Pa or kPa allow 262 740 (Pa)	3
(iii)	any two from: MP1. idea that {weight of ship / downwards force} is greater; MP2. larger pressure difference (when deeper in water); MP3. larger upthrust force (needed to keep forces balanced);	allow ship is heavier, ship has more mass allow larger pressure (on bottom of ship)	2

Total for Question 2 = 11 marks

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Question number	Answer	Notes	Marks
3 (a)	A (current); B is incorrect because power is the rate of energy transferred C is incorrect because resistance is the ratio of voltage and current D is incorrect because voltage is the energy transferred per unit charge passed		1
(b)	D (voltage); A is incorrect because current is the rate of flow of charge B is incorrect because power is the rate of energy transferred C is incorrect because resistance is the ratio of voltage and current		1
(c) (i)	correct voltmeter symbol used; voltmeter drawn in parallel with S;	 condone drawn in parallel with R or the battery	2
(ii)	0.20 (A); 0.60 (A);	this order only allow 0.2 (A) this order only allow 0.6 (A)	2
(iii)	voltage = current × resistance; substitution; evaluation; e.g. $V = I \times R$ (V =) 0.40×11 (V =) 4.4 (V)	formula should be seen or implied by calculation allow standard symbols and rearrangements ignore C, c for current	3
(iv)	idea that voltage across battery is the same as voltage across R; (because) battery and R are connected in parallel / no other resistive components on loop with battery and R;	allow numerical value given e.g. 'voltage of battery = 4.4V'	2
(d)	idea that resistance (of thermistor) changes; when temperature increases, resistance decreases; (therefore) current increases when temperature increases;	allow even if relationship is the wrong way round ORA ORA	3

Total for Question 3 = 14 marks

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Question number	Answer	Notes	Marks
4 (a) (i)	weight = mass × gravitational field strength;	allow rearrangements and standard symbols e.g. $W = m \times g$ ignore 'gravity' for g	1
(ii)	substitution or rearrangement; evaluation; e.g. 520 = mass × 10 OR mass = W / g (mass =) 52 (kg)	 allow g = 9.8, 9.81 allow 53.1, 53.0, 53	2
(b) (i)	evidence of counting squares to find area; number of squares in range 37-42; evaluation of area of one square; evaluation of total area; e.g. dots seen in each square in diagram number of squares = 39 area of one square = (2 × 2) = 4 cm^2 total area = (4 × 39) = 156 cm^2	allow attempt to find area by splitting into rectangles / triangles allow if 2 × 2 seen in working allow ecf from incorrect number of squares allow 148-168	4
(ii)	pressure = force / area;	allow standard symbols and rearrangements e.g. p = F / A	1
(iii)	dimensionally correct substitution; evidence of doubling area or halving pressure to account for both feet; evaluation with matching unit; e.g. (pressure =) 520 / 156 area = 156 × 2 OR pressure = 3.2 ÷ 2 (pressure =) 1.7 N/cm^2	allow ecf from (b)(i) allow N/cm^2, N/m^2 or Pa if no marks awarded for calculation allow 1 mark if valid unit for pressure given allow 1.5-1.8 N/cm^2 allow 15 000-18 000 N/m^2	3

Total for Question 4 = 11 marks

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Question number	Answer	Notes	Marks
5 (a) (i)	B, D, F;	all required for the mark reject if additional sections listed	1
(ii)	use of speed = distance / time;	seen anywhere allow symbols allow attempt to find gradient of line	4
	correctly read time or distance from graph; conversion from minutes to seconds or km to m; correct evaluation;		
	e.g. v = s / t distance = 2.6 km or time = 2 minutes distance = 2600 m or time = 120 s (v =) 22 (m/s)	allow s = d / t allow 21.7, 21.6… (m/s) 0.0216…, 1300 = 3 marks 1.3 = 2 marks	
(iii)	idea that speed of bus is greater in section A; (because) line is steeper / gradient is larger / eq;		2
(b)	single horizontal line drawn;	judge by eye line must extend the entire length of the time axis	2
	horizontal line drawn at 0.5 km/minute for some period of time in journey;		

Total for Question 5 = 9 marks

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Question number	Answer	Notes	Marks
6	any six from: MP1. cup slows down/stops energy transfer to surroundings; **relating to conduction:** MP2. vacuum contains no particles; MP3. reducing/stopping conduction (through the sides); MP4. plastic (lid) is a poor conductor / good insulator; **relating to convection:** MP5. air is trapped by the lid; MP6. reducing/stopping convection (from the surface); **relating to radiation:** MP7. (inner) shiny surface is poor absorber of infrared / radiation; MP8. (outer) shiny surface is poor emitter of infrared / radiation; MP9. energy transfer by radiation reduced/stopped;	allow idea that <u>energy</u> is trapped ignore 'heat is trapped' allow reducing/stopping evaporation allow idea that inner surface reflects heat	6

Total for Question 6 = 6 marks

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Question number	Answer	Notes	Marks
7 (a)	24 (kPa);		1
(b)	any three from: MP1. reading increases / pressure increases; MP2. reading doubles / pressure doubles/ reading is 48 kPa; MP3. (because) air particles collide with walls more **often**; MP4. (because) pressure × volume is constant;	 scores first 2 marks allow quoted formula allow (because) pressure is inversely proportional to volume	3
(c) (i)	{speed / velocity / KE} of particles decreases;	allow less frequent collisions ignore 'motion / movement decreases'	1
(ii)	pressure decreases; particles collide with walls less often; particles collide with less force;	 allow particles colliding less hard	3

Total for Question 7 = 8 marks

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Question number	Answer	Notes	Marks
8 (a) (i)	acceleration = change in velocity / time;	allow rearrangements and standard symbols e.g. a = v-u / t, a = Δv/t, a = Δv/Δt	1
(ii)	substitution; rearrangement; evaluation; e.g. 1.2 = (35 – 26) / t t = 9 / 1.2 (t =) 7.5 (s)		3
(b)	any four from: MP1. frequency increases; MP2. due to Doppler effect; MP3. idea that car behaves as the source of the (reflected) waves; MP4. (reflected) wavefronts closer together; MP5. (reflected) wavelength decreased; MP6. speed (of waves) stays constant;	 allow "waves become bunched up" allow quotation of $v = f \times \lambda$	4

Total for Question 8 = 8 marks

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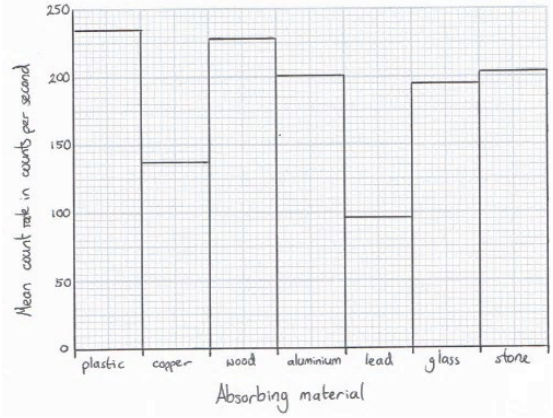
Question number	Answer	Notes	Marks
9 (a)	Geiger-Muller tube / GM tube;	allow Geiger counter, Geiger meter, GM detector	1
(b)	(absorbing) material;	allow absorber	1
(c)	any two from: MP1. idea that thickness also affects the count/results; MP2. idea that thickness is a control variable; MP3. idea of making experiment valid;	 allow fair test for valid	2
(d)	measure count over longer time / take more repeats / measure background count;	allow quoted time longer than 3 seconds	1
(e) (i)	suitable linear scale chosen (>50% of grid used); axes labelled with quantities and unit; <u>all</u> bar plotting correct to nearest half square;  	ignore orientation do not accept multiples of 30 for scale **Absorbing material** / **Mean** plastic 235 copper 137 wood 227 aluminium 202 lead 97 glass 195 stone 203	3
(ii)	B (absorbing material is not a continuous variable); A is incorrect because absorbing material is not a continuous variable C is incorrect because line graphs are drawn for continuous variables D is incorrect because count rate is a continuous variable		1
(iii)	idea that the lower the count, the better the absorber; lead is the best absorber;	ignore student is right/wrong allow RA allow that plastic is the worst absorber	2

Total for Question 9 = 11 marks

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Question number	Answer	Notes	Marks
10 (a) (i)	light {refracts, bends, changes direction, changes speed, changes wavelength} = 1 mark; light {refracts/bends towards normal, slows down, wavelength decreases} = 2 marks;;		2
(ii)	normal;		1
(iii)	sin(c) = 1/n;	allow in words and rearrangements	1
(iv)	substitution; rearrangement; evaluation; e.g. sin(c) = 1/1.6 (c =) $\sin^{-1}(0.625)$ (c =) 39 (°)	 allow 38.68…	3
(v)	TIR at the glass/air boundary; angle of incidence = angle of reflection;	allow ecf from (iv) that would suggest refraction e.g. if answer to (iv) is greater than 50° judge by eye	2
(b)	light ray is refracted out into the air; refracting away from the normal;	ray does not need to show deviation reject if ray emerges to the left of the normal	2

Total for Question 10 = 11 marks

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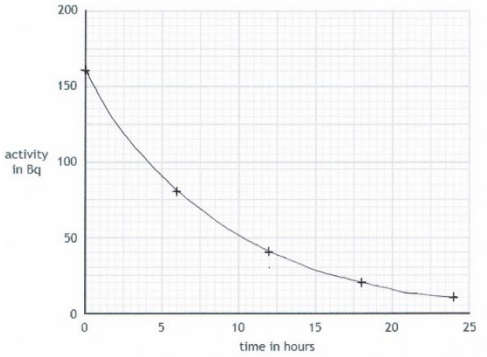
Question number	Answer	Notes	Marks
11 (a)	activity shown to decrease over time; descending curve getting shallower starting at (0,160); line passes through two other valid points; • (6,80) • (12,40) • (18,20) • (24,10)  		3
(b) (i)	idea that it decays very quickly / activity will be zero by the time it is injected / there will be no technetium-99m left;	ignore 'it has a short half-life'	1
(ii)	any **one** from: • idea that gamma can penetrate out of the body; • idea that gamma can be detected outside the body; any **one** from: • idea that half-life is long enough to complete the procedure; • idea that activity will fall to safe level in a day / quickly;	marks must be from separate lists allow idea that technetium will not be in body for very long	2
(c)	harmful effect of gamma radiation given; idea that patient will have procedure very rarely / only when necessary (so risk is low); idea that doctor will administer procedure regularly (so risk is higher) / doctor limits time exposure to patient (to reduce risk);	e.g. • cancer • cell damage • cell mutation allow suggestion that risk to patients is higher as they receive greater dose allow idea that doctor increases distance from patient (to reduce risk)	3

Total for Question 11 = 9 marks

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Question number	Answer	Notes	Marks
12 (a)	comet drawn in orbit around the Sun; orbital path is elliptical;	 judge by eye allow partially drawn ellipse Sun need not be at a focus of the ellipse, but should not be at the centre of the ellipse	2
(b)	attempted use of orbital speed formula; valid substitution into orbital speed formula; correct evaluation of time period for either planet; attempt to divide T for Saturn by T for Mars; correct final evaluation of ratio; e.g. $v = 2 \times \pi \times r / T$ $24.1 = 2 \times \pi \times 2.28 \times 10^8 / T$ $T_{Mars} = 5.94 \times 10^7$ (s) OR $T_{Saturn} = 9.26 \times 10^8$ (s) $n = T_{Saturn} / T_{Mars}$ 15.6	allow for either planet seen anywhere in working $9.70 = 2 \times \pi \times 1.43 \times 10^9 / T$ 5.944… 9.2628… allow range of 15-16	5

Total for Question 12 = 7 marks

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