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Mark Scheme (Results)

Summer 2019

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) (i)	arrow originating at object A and directed towards the star by eye; arrow labelled gravitational (force);	 allow weight, gravitational force, pull or force of gravity condone gravity	2
(ii)	D - (a planet); A is incorrect because comets have comets have elliptical orbits B is incorrect because galaxies do not orbit anything C is incorrect because moons orbit planets		1
(iii)	A - (a comet); B is incorrect because galaxies do not orbit anything C is incorrect because moons orbit planets D is incorrect because planets have circular orbits		1
(b)	galaxy;	allow named galaxy e.g. Andromeda, Milky Way ignore universe	1
(c)	spectral class B to have any temperature higher than 5600 K; spectral class M to have any temperature lower than 5600 K;		2
(d)	star becomes a red (super) giant; (then) a supernova; (leaving) a neutron star / black hole;	allow “supergiant” allow pulsar Max 2 for incorrect order	3

Total for Question 1 = 10 marks

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Question number	Answer	Notes	Marks
2 (a) (i)	reduce the kinetic energy of <u>neutrons</u>;	allow 'slow down' <u>neutrons</u>	1
(ii)	to absorb (high energy) neutrons;	allow absorb / reduce strength of neutron radiation condone "stop neutrons escaping"	
	use of (concrete / lead) shielding;	allow "concrete walls"	
(iii)	idea that contamination is when a non-radioactive object comes into contact with a radioactive material; idea that irradiation is when radiation is present;	Condone idea of exposure for 1 mark if no other mark scored	2
(b) (i)	any two from: MP1. creation of a (large) nucleus from small <u>nuclei</u>; MP2. resulting in a loss of mass; MP3. and the release of energy;	condone "fusing of two nuclei" accept reference to $E=mc^2$ condone "converted to energy"	2
(ii)	(in) star(s);	allow named star e.g. The Sun	1
(iii)	any three from: MP1. high temperature required; MP2. to increase kinetic energy of nuclei; MP3. high pressure required; MP4. (because) <u>nuclei</u> need to be close enough to collide; MP5. (since) <u>nuclei</u> repel each other;	 allow to make nuclei move faster allow particles or atoms for this MP allow higher level answers in terms of short range strong nuclear force	3

Total for Question 2 = 11 marks

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Question number	Answer	Notes	Marks
3 (a)	(nuclei with) the same number of protons; (but) different number of neutrons;	allow same atomic number / same element allow different nucleon / mass number /atomic mass	2
(b)	A (82); B is incorrect because this is the number of neutrons C is incorrect because this is the number of nucleons D is incorrect because this is double the proton number + nucleon number		1
(c) (i)	evidence of 3 half-lives; correct evaluation; e.g. $240 \div 2^3 = 30$ $66 \div 3 = 22$ (years)	seen anywhere in working	2
(ii)	correct atomic and mass numbers used for alpha particle; correct evaluation of number of beta particles; e.g. atomic number of alpha = 2, mass number = 4 (therefore) 2 beta decays (to get back to 82) 	seen anywhere in working	2

Total for Question 3 = 7 marks

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Question number	Answer	Notes	Marks
4 (a) (i)	by radiation / by (infrared) light;	ignore "heat" Allow EM waves/IR, condone visible, UV, sunlight	1
(ii)	(average speed) increases;	condone "light rays" e.g. "faster"	1
(b) (i)	Either idea that water temperature is greater than the outside temperature; Or not receiving radiation / light from the Sun;	allow RA condone 'heat' or 'sunlight' for 'light' or 'radiation'	1
(ii)	any four from: MP1. cover traps air; MP2. (trapped) air is a poor conductor / (good) insulator; MP3. plastic is a poor conductor / (good) insulator; MP4. conduction reduced; MP5. convection reduced / stopped; MP6. less evaporation (from water surface);	ignore reference to radiation ignore 'traps heat' condone "conduction stopped" condone "no evaporation"	4

Total for Question 4 = 7 marks

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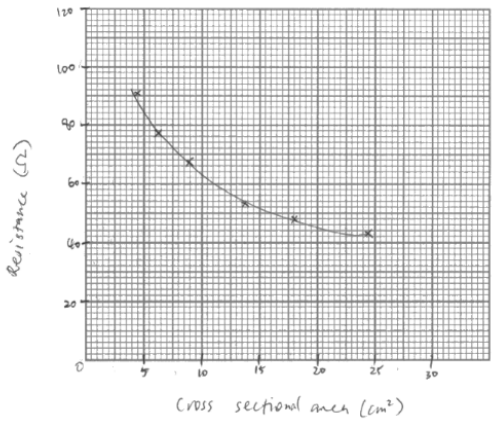
Question number	Answer	Notes	Marks
5 (a) (i)	diameter measured within range 3.5-4.0 cm; evidence of finding a mean of the diameter;		2
(ii)	substitution of radius into given formula; evaluation of area within range 9.6-12.6 cm^2;	1 mark max if diameter used instead of radius	2
(b) (i)	correct circuit symbols for both voltmeter and ammeter; ammeter connected in series; voltmeter connected in parallel with putty cylinder;	accept voltmeter connected in parallel with battery allow voltmeter connected in parallel across putty and ammeter	3
(c) (i)	42.6; 3 s.f. used;	allow 42.6168... mark independently	2
(ii)	suitable linear scale chosen (>50% of grid used); axes labelled with quantities and units; plotting correct to nearest half square;	orientation needs to be correct all points must be correct ignore plotting of final point	3
(iii)	line (curve) of best fit acceptable;	allow ECF from plotting i.e. smooth curve with points evenly distributed about it	1

Cross-sectional area in cm^2	Voltage in V	Current in A	Resistance in Ω
4.5	4.56	0.049	91.2
6.2	4.56	0.059	77.3
9.1	4.56	0.068	67.1
13.9	4.56	0.085	53.6
18.1	4.56	0.094	48.5
24.6	4.56	0.107	



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(d)	voltage stays the same; (because) each putty cylinder is connected in parallel (with the cells); total current doubles; (because) current in each putty cylinder stays the same (as before) and these currents add together;	 allow current increases allow resistors in parallel have lower **total** resistance allow correct use of resistors in parallel formula	4

Total for Question 5 = 17 marks

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Question number	Answer	Notes	Marks
6 (a) (i)	density = mass / volume;	allow rearrangements and use of symbols e.g. $V = m / \rho$ or $D = M/V$	1
(ii)	substitution OR rearrangement; evaluation; e.g. $V = m / \rho$ OR $2.3 = 19 / V$ (V =) 8.3 (cm^3)	 allow 8.26…	2
(b) (i)	pressure difference = height x density x g;	allow use of standard symbols e.g. $p = h \times \rho \times g$ reject 'gravity'	1
(ii)	substitution; evaluation; e.g. (p =) 5.6 x 1000 x 10 (p =) 56 000 (Pa)	accept use of g = 9.8(1) m/s^2 -1 if POT error in substitution Use of 9.8 gives 54 880 Use of 9.81 gives 54 936 Both round to 55 000	2

Total for Question 6 = 6 marks

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Question number	Answer	Notes	Marks
7 (a)	**measuring equipment:** MP1. ruler / tape measure; MP2. stopclock / stopwatch; **variables:** MP3. surface material is the independent variable; MP4. (average) speed is the dependent variable; MP5. any one control variable from; • size / mass / material / area /weight of block • height/angle/gradient of ramp • initial force given to block • distance travelled down the ramp **determining average speed:** MP6. use of (average) speed = distance travelled / time	allow if clearly included in diagram condone 'timer' accept use of light gates if connected to timing device e.g. computer/datalogger accept 'camera' if subsequent method describes 'freeze-frame'/timestamp technique allow time as the dependent variable allow 'keep constant' for 'control variable' allow 'push' given to block allow **initial** speed or velocity allow same starting point and finishing point accept use of light gate if description includes length of card/block and time of transit	6
(b)	(bar chart because) surface material is a {categoric / discontinuous / non-continuous} variable;	condone surface material being a discrete variable	1

Total for Question 7 =7 marks

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Question number	Answer	Notes	Marks
8 (a) (i)	D – (weight and air resistance are equal); A, B and C cannot be correct because accelerations, forces and velocities are not the same SI quantities.		1
(ii)	C – (2300 m); A cannot be correct because each large square represents 200 m and the area is larger than one large square. B cannot be correct because the area is larger than 6.5 large squares D cannot be correct because the area is lower than 12.5 large squares		1
(b)	any four from: MP1. air resistance increases (greatly) when parachute is opened; MP2. idea that air resistance is greater than the weight; MP3. (therefore) deceleration / upwards acceleration; MP4. idea that air resistance decreases with speed; MP5. resultant force (eventually) becomes zero; MP6. constant speed achieved	allow "drag" for air resistance throughout allow "upwards force" allow upwards force is bigger than downwards force allow idea of upwards resultant force ignore "velocity decreases" allow "forces are balanced again" allow air resistance = weight allow idea that there is no acceleration	4
(c)	D – (thermal store); A cannot be correct as there is no mechanism for this transfer B cannot be correct as the gravitational store is decreasing C cannot be correct as the jumper is at constant velocity		1

Total for Question 8 = 7 marks

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Question number	Answer	Notes	Marks
9 (a) (i)	light ray refracting and bending in the correct direction;	ignore any response in the air e.g. reflected wavefronts or direction of travel of reflected ray	3
	wavefronts in water drawn closer together by eye;	allow wherever seen in diagram	
	wavefronts drawn in water join up with wavefronts in air;		
(ii)	wavelength decreases; (because) wave speed decreases **and** frequency remains constant;		2
(b) (i)	normal drawn at right angles where light ray meets boundary;	judge by eye	1
(ii)	55°;	allow range 54-56°	1
(iii)	substitution into sin c = 1/n; rearrangement; evaluation; e.g. sin c = 1/1.6 (c =) $\sin^{-1}$ (1/1.6) (c =) 39°	 condone intermediate rounding allow 38.682…	3
(iv)	(path shows) total internal reflection;	allow TIR	3
	(because) ray is travelling from high to low refractive index;	however expressed e.g. reduction of (optical) density / increase in speed from glass to air	
	(and) angle of incidence is greater than the critical angle;		

Total for Question 9 = 13 marks

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Question number	Answer	Notes	Marks
10 (a) (i)	friction / air resistance / drag;		1
(ii)	1000 (N);		1
(b) (i)	(resultant) force = mass × acceleration;	allow rearrangements and standard symbols e.g. a = F/m	1
(ii)	substitution AND rearrangement; evaluation; unit; e.g. (a =) (-)14000 / 1900 (a =) (-)7.4 m/s^2	-1 for POT error mark independently Condone 7.4, 7.36842…, etc. accept $m\,s^{-2}$ ignore N/kg	3
(iii)	substitution into $v^2 = u^2 + 2as$; rearrangement; evaluation; e.g. $0 = 18^2 + (2 \times -7.4 \times s)$ (s =) 324 / (2 x 7.4) (s =) 22 (m)	allow ecf from (b)(ii) no mark for equation alone as given -1 if negative sign given with answer allow answer in range 21.8-22.0 from rounding differences allow time to stop of 2.4… (s) for 1 mark	3
(iv)	any two **described** factors from: MP1. increased mass (of van); MP2. increased speed (of van); MP3. idea of less friction on the road e.g. road being wet / icy etc; MP4. idea of worn vehicle parts e.g. tyres / brakes etc.; MP5. van travelling downhill;	ignore condition of driver allow weight for mass allow KE for speed	2

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(c)	calculation of new acceleration (5.6); substitution into a = (v – u) / t; rearrangement; evaluation; e.g. new acceleration = 5.6 (m/s^2) 5.6 = 18 / t (t =) 18/5.6 (t =) 3.2 (s)	-1 if POT error allow ecf from acceleration value allow use of previously calculated acceleration award full marks for momentum method i.e. recall of F = (mv-mu)/t; substitution; rearrangement; evaluation; allow 3.214… ignore negative reject 25000/14000 x 18 (i.e. mass x 10 x speed/force) which gives 32.	4

Total for Question 10 = 15 marks

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Question number	Answer	Notes	Marks
11 (a)	MP1. method to show **shape;** e.g. use compass(es) use of iron filings/powder MP2. use of plotting compass **to show direction;** MP3. a further method detail; e.g. move compass / multiple compasses in different positions idea of another line or lines added sprinkle iron filings (on to card) tap card (to distribute iron filings)	all marks may be given from diagram	3
(b) (i)	both arrows correctly pointing from north to south;	reject if arrows contradict	1
(ii)	idea that field lines are closer together / further apart; (showing that) field strongest near the poles / weaker away from the poles;	 allow "magnet" for "poles"	2
(c)	any pair of readings read from the graph; correct substitution into formula to find constant; different pair of readings used correctly to find constant; statement that the results agree with the conclusion; e.g. when distance = 30mm, magnetic field strength = 2.3 mT $(2.3 \times 30^2 =)$ 2070 $(0.8 \times 50^2 =)$ 2000 constants are approximately the same so results agree with conclusion	 DOP allow idea that the constants are different so the results do not agree with the conclusion	4

Total for Question 11 = 10 marks