



Mark Scheme (Results)

January 2022

Pearson Edexcel International GCSE

In Physics (4PH1) Paper 1P and Science

(Double Award) (4SD0) Paper 1P

Question number	Answer	Notes	Marks
1 (a)	B; A is incorrect because the top two field lines are in the wrong direction C is incorrect because all the field lines are in the wrong direction D is incorrect because the second field line from the top is in the wrong direction		1
(b) (i)	B; A is incorrect because there is a magnetic force on each of the magnets C is incorrect because the two nearest poles are opposite not alike D is incorrect because the forces on the magnets pass through their centres of gravity		1
(ii)	C; A is incorrect because the field lines are not straight nor parallel to each other B is incorrect because the field lines are not straight nor parallel to each other D is incorrect because the field lines are not parallel to each other		1
(c)	steel / nickel / cobalt / neodymium;	condone iron	1
(d)	EITHER: (plotting) compass used; multiple compasses or repeated use of single compass; joining up of dots/idea of compasses forming continuous line; OR iron filings used; sprinkled / eq; card tapped (to reveal pattern);	all marks can be awarded from a diagram ignore 'poured' or other heavy-handed method	3

Total for Question 1 = 7 marks

Question number	Answer	Notes	Marks
2 (a)	idea of subtracting the background count rate;		1
(b) (i)	time taken; and either of for (radio)activity to halve; for half of the (radioactive) nuclei / atoms / isotope to decay;	allow "how long it takes" reject "half the time" allow count rate for activity ignore mass, substance	2
(ii)	indication on graph of a half in count rate; 2.6 (minutes);	e.g. line drawn across from 25 until it reaches the curve, then down to the time axis allow 2.5-2.7 (minutes) 2.3 (minutes) = 1 mark	2

Total for Question 2 = 5 marks

Question number	Answer	Notes	Marks
3	(a) (i)	travel at the same speed (in a vacuum) / can travel in a vacuum;	1
	(ii)	wavelength;	1
	(b) (i)	speed = frequency $\times$ wavelength;	1
	(ii)	substitution OR rearrangement; evaluation; e.g. $3.0 \times 10^8 = 5.2 \times 10^9 \times \lambda$ OR $\lambda = v / f$ (wavelength =) 0.058 (m)	2
(c)	(i)	D;	1
	(ii)	A is incorrect because electromagnetic waves are not longitudinal B is incorrect because electromagnetic waves are not mechanical waves C is incorrect because sound waves are not electromagnetic waves vibrations / oscillations; correct relationship between direction of travel/energy transfer and direction of vibration for both transverse and longitudinal waves;	2

Total for Question 3 = 8 marks

Question number	Answer	Notes	Marks
4 (a)	protractor;		1
(b) (i)	any indication that the angle is between the normal and the incident ray;		1
(ii)	79 (degrees);	allow 78-80 (degrees) ecf from indicated angle of incidence in (i) e.g. 10-12 (degrees) if angle marked between ray and boundary	1
(iii)	any straight ray to the right of the normal that comes from the point of incidence; correct angle of reflection;	judge by eye judge by eye	2

Total for Question 4 = 5 marks

Question number	Answer	Notes	Marks
5 (a)	(i) (average) speed = distance (travelled) ÷ time (taken);	allow standard symbols and rearrangements e.g. $v = s / t$ allow s, d for distance condone s for speed	1
	(ii) substitution OR rearrangement; evaluation; e.g. $21 = \text{distance} / 0.14$ OR $s = v \times t$ (distance =) 2.9 (m)	allow 3, 2.94 (m)	2
(b)	(i) force = mass × acceleration;	allow standard symbols and rearrangements e.g. $a = F / m$	1
	(ii) substitution OR rearrangement; evaluation; e.g. $7600 = 1200 \times a$ OR $a = F / m$ (a =) (-)6.3 (m/s ²)	allow 6.33... (m/s ²)	2
	(iii) substitution into $v^2 = u^2 + 2as$; rearrangement; evaluation; e.g. $0^2 = 21^2 + [2 \times (-)6.3 \times \text{distance}]$ distance = 441 / 12.6 distance = 35 (m)	ecf answer from (ii) allow 34.8...(m)	3

Total for Question 5 = 9 marks

Question number	Answer	Notes	Marks
6 (a)	(i) any attempt to find gradient of graph; use of two points on the line to calculate gradient; evaluation; e.g. acceleration = gradient acceleration = $(-4.2 / 0.45)$ (acceleration =) $-9.3 \text{ (m/s}^2\text{)}$	allow use of acceleration formula allow reading of pair of velocities with matching time interval reject positive answer allow -9.3 to -9.4	3
	(ii) any clear indication that distance travelled = area; correct use of data from graph; evaluation; e.g. distance = area distance = $0.5 \times 0.45 \times 4.2$ (distance =) 0.95 (m)	accept alternative method using $v^2 = u^2 + 2as$ with acceleration calculated in (i) allow attempt to calculate area of triangle allow $0.94, 0.945 \text{ (m)}$	3
(b)	(i) weight / gravitational force; drag / air resistance;	ignore unqualified 'gravity', gravitational field strength ignore upthrust, lift	2
	(ii) one upward arrow and one downward arrow drawn; arrows originate at object; downward arrow drawn longer than upward arrow;	judge by eye judge by eye	3
	(iii) any four from: MP1. object is accelerating (from A to B); MP2. downward force greater than upward force (at A); MP3. gradient / acceleration decreasing (from A to B); MP4. drag increases as speed increases; MP5. resultant force decreases; MP6. idea that (just after) B, downward force = upward force; MP7. idea that in region BC, acceleration is zero/close to zero; MP8. terminal velocity achieved in region BC;	allow speeding up allow any recognisable upward force and downward force allow any recognisable upward force and downward force allow constant velocity	4

Total for Question 6 = 15 marks

Question number	Answer	Notes	Marks
7 (a)	(i) idea that voltage across thermistor + voltage across fixed resistor = voltage across cell; 0.59 (V);	allow 0.632 (V)	2
	(ii) voltage = current $\times$ resistance;	allow standard symbols and rearrangements e.g. V, I and R ignore c, C for current	1
	(iii) substitution; rearrangement; evaluation; e.g. $0.59 = 0.0062 \times R$ $R = 0.59 / 0.0062$ (R =) 95 (Ω)	ecf answer from (i) -1 for POT error answers of $R = 90.7...$ or $R = 101.9...(\Omega)$ gain full marks answer of 242 (Ω) gains 2 marks allow 95.2, 95.16... condone 95.1	3
(b)	(i) idea that resistance of thermistor decreases with an increase in temperature; idea of non-linear relationship;	allow idea that rate of change is decreasing resistance inversely proportional to temperature scores both marks	2
	(ii) voltmeter reading decreases; (because) resistance of thermistor increases; idea that current in circuit/thermistor decreases;	allow voltage across resistor decreases	3

Total for Question 7 = 11 marks

Question number	Answer	Notes	Marks														
8 (a)	(i) idea that kinetic store increases;	e.g. chemical transferred to kinetic	1														
	(ii) idea that gravitational store increases;		1														
(b)	two correct statements ticked;; <table><tr><th>Statement</th><th>Correct (✓)</th></tr><tr><td>gravitational store increases</td><td>✓</td></tr><tr><td>gravitational store stays the same</td><td></td></tr><tr><td>gravitational store decreases</td><td></td></tr><tr><td>kinetic store increases</td><td></td></tr><tr><td>kinetic store stays the same</td><td></td></tr><tr><td>kinetic store decreases</td><td>✓</td></tr></table>	Statement	Correct (✓)	gravitational store increases	✓	gravitational store stays the same		gravitational store decreases		kinetic store increases		kinetic store stays the same		kinetic store decreases	✓	3 ticks scores 1 max 4 or more ticks scores 0	2
Statement	Correct (✓)																
gravitational store increases	✓																
gravitational store stays the same																	
gravitational store decreases																	
kinetic store increases																	
kinetic store stays the same																	
kinetic store decreases	✓																
(c)	(i) gravitational (force);	allow weight, gravity	1														
	(ii) substitution into given formula; evaluation; e.g. orbital speed = $(2 \times \pi \times 7100) / 5800$ (orbital speed =) 7.7 (km/s)	allow 7.69... (km/s)	2														
(d)	any four from: MP1. bars increase in temperature when facing towards Sun / decrease in temperature when facing away from Sun; MP2. (when pointed at the Sun,) black bar increases temperature faster than white bar; MP3. (because) black is a better absorber of radiation than white; MP4. (so) black bar reaches a higher temperature than white bar; MP5. (when pointed away from the Sun,) black bar decreases temperature faster than white bar; MP6. (because) black is a better emitter of radiation than white; MP7. convection/conduction plays no part in heat transfer (outside the spacecraft); MP8. (because) there are no particles outside the spacecraft;	accept any clear reverse argument allow energy, heat, IR for radiation allow energy, heat, IR for radiation	4														

Total for Question 8 = 11 marks

Question number	Answer	Notes	Marks																		
9 (a)	any five from: MP1. measure original length of spring; MP2. measure new length / extension for a range of masses; MP3. extension = new length - original length; MP4. use of ruler; MP5. method of avoiding parallax, e.g. look at eye level or use a pointer; MP6. use of a set square / clamping ruler vertically; MP7. idea of measuring between the same two points (on the spring); MP8. idea of repeating and averaging; MP9. idea of measuring extension with decreasing mass as well;	allow any marking points if seen on diagram allow tape measure allow repeating to identify anomalies	5																		
(b) (i)	suitable linear scale chosen (>50% of grid used); axes labelled with quantities and units; all plotting correct to nearest half square;	ignore orientation <table><tr><th>Force in N</th><th>Extension in cm</th></tr><tr><td>0.0</td><td>0.0</td></tr><tr><td>1.0</td><td>2.5</td></tr><tr><td>2.0</td><td>5.0</td></tr><tr><td>3.0</td><td>9.8</td></tr><tr><td>4.0</td><td>10.0</td></tr><tr><td>5.0</td><td>12.5</td></tr><tr><td>6.0</td><td>15.5</td></tr><tr><td>7.0</td><td>19.5</td></tr></table>	Force in N	Extension in cm	0.0	0.0	1.0	2.5	2.0	5.0	3.0	9.8	4.0	10.0	5.0	12.5	6.0	15.5	7.0	19.5	3
Force in N	Extension in cm																				
0.0	0.0																				
1.0	2.5																				
2.0	5.0																				
3.0	9.8																				
4.0	10.0																				
5.0	12.5																				
6.0	15.5																				
7.0	19.5																				
(ii)	data point at (3.0,9.8) identified;	allow (7.0,19.5) as chosen point	1																		
(iii)	straight line of best fit passing through origin and non-anomalous points;	ecf from plotting in (i) ignore line beyond 6.0N	1																		
(iv)	any three from: MP1. quotation of Hooke's Law; MP2. line is straight; MP3. line passes through origin; MP4. no evidence of having passed elastic limit;	i.e. force and extension should be proportional allow idea that line is not straight if consistent with (iii) allow idea that elastic limit has been reached if consistent with (iii)	3																		

Total for Question 9 = 13 marks

Question number	Answer	Notes	Marks
10 (a) (i)	36 (degrees);		1
(ii)	refractive index = $\sin(i) / \sin(r)$;	allow standard symbols and rearrangements e.g. $n = \sin(i) / \sin(r)$	1
(iii)	substitution; evaluation; answer quoted to 2 s.f.; e.g. refractive index = $\sin(61) / \sin(36)$ (refractive index =) 1.48799... (refractive index =) 1.5	allow ecf from (i) mark independently	3
(b)	red refracts less than violet; correct link made between colour and refractive index; correct link made between wavelength and refractive index;	allow RA allow red bends less than violet e.g. red has a lower refractive index than violet e.g. refractive index decreases with increasing wavelength	3

Total for Question 10 = 8 marks

Question number	Answer	Notes	Marks
11 (a) (i)	rearrangement OR substitution into given formula; evaluation; e.g. $V_2 = p_1 \times V_1 / p_2$ OR $120 \times 92 = 64 \times V_2$ (volume =) 170 (m ³)	allow 172, 173, 172.5	2
(ii)	constant temperature / amount of air / mass of air;	however expressed e.g. number of particles constant	1
(b) (i)	any three from: MP1. (reduction in temperature) reduces speed/KE of particles; MP2. idea of fewer collisions with walls per unit time; MP3. idea of each collision with wall being less 'hard'; MP4. force (per unit area) on the container decreases;	allow particles collide with walls less often	3
(ii)	substitution into given formula; rearrangement; evaluation; e.g. $120 / 290 = 64 / T_2$ $T_2 = (64 \times 290) / 120$ (temperature =) 150 (K)	allow 155, 154.6... (K)	3

Total for Question 11 = 9 marks

Question number	Answer	Notes	Marks
12 (a)	calculation of energy transferred by battery; efficiency formula stated; correct substitution; evaluation; e.g. energy supplied = $VIt = 12 \times 0.25 \times 12 = 36 \text{ (J)}$ efficiency = $\frac{\text{useful energy output}}{\text{total energy output}}$ efficiency = $25 / 36 (\times 100\%)$ efficiency = 69 (%)	36 (J) seen seen or implied anywhere in working allow ecf from battery energy if clear 25/36 ($\times 100$) seen allow 70, 69.4...(%)	4
(b) (i)	current / coil has a magnetic field; interaction between fields; resulting in a force; forces on opposite sides of the coil are in opposite directions;	ignore references to attraction / repulsion	4
(ii)	C - YZ; A is incorrect because WX moves downwards B is incorrect because part of XY moves downwards D is incorrect because part of ZW moves downwards		1

Total for Question 12 = 9 marks