Mark Scheme (Results)

Summer 2022

Pearson Edexcel International GCSE

In Science Double Award (4SD0) Paper 1PR

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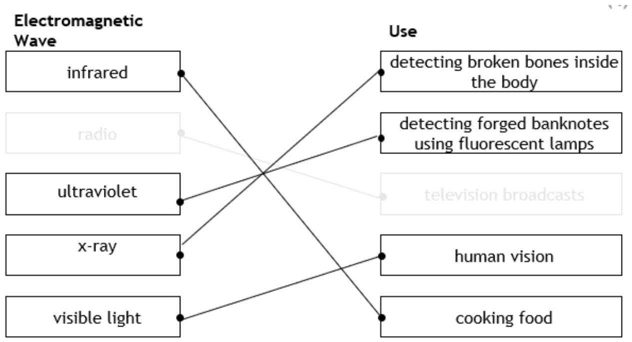
General Marking Guidance

- 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.

Question number	Answer	Notes	Marks
1 (a)	D – a star; A and C cannot be correct because satellites orbit planets B cannot be correct because comets orbit stars		1
(b)	D – universe; A cannot be correct because there are billions of galaxies in the Universe B and C cannot be correct because there are billions of stars and their solar systems in each galaxy		1
(c)	B – moon; A cannot be correct as there are billions of stars and their solar systems in each galaxy C cannot be correct because moons orbit planets and those planets orbit stars D cannot be correct because a solar system includes stars planets and moons		1
(d)	Earth has a larger mass than the Moon;	accept reverse argument allow Earth has a larger density condone referring to Moon as a planet condone idea of different mass ignore reference to size	1

(Total for Question 1 = 4 marks)

Question number	Answer	Notes	Marks
2 (a)	;;;;  		4
(b)	skin burns;	apply 'list' principle allow 'damage to skin cells'	1
(c)	reduce time of exposure/ increase distance from source/ introduce more material between source and person; e.g. suncream, clothing, sunglasses, staying indoors, stay behind glass windows, only stay outside for 20 minutes without sun protection	apply 'list' principle	1

(Total for Question 2 = 6 marks)

Question number	Answer	Notes	Marks
3 (a) (i)	voltmeter in parallel with component X;		1
(ii)	light dependent resistor / LDR;		1
(b) (i)	evidence of use of graph; 1700 (ohms);	accept range 1650-1750 (ohms) allow full marks for 1700	2
(ii)	evidence of use of voltage = current x resistance; substitution; evaluation; correct answer = 3.1 (V) e.g. V = IR V = 0.0018 × 1700 V = 3.06 (V)	allow use of standard symbols e.g. V = I × R accept v, V, i , I, r, R allow ECF from (i)	3
(iii)	brightness decreases; plus ONE from: resistance (of circuit) increases; current in circuit decreases;	reject reference to covering the lamp reducing the brightness of the lamp	2

(Total for Question 3 = 9 marks)

Question number	Answer	Notes	Marks
4 (a)	zero/0 (N);		1
(b) (i)	pressure = depth × density × gravitational field strength;	allow use of standard symbols e.g. $p = h \times \rho \times g$ allow 'd' for 'h' reject 'gravity' for 'g' in formula	1
(ii)	substitution; evaluation; e.g. pressure = depth × density × gravitational field strength pressure = 0.041 × 1000 × 10 pressure = 410 (Pa)	 -1 POT error allow use of 9.8(1) for 'g' giving 401.8…	2
(iii)	pressure = force ÷ area;	allow use of standard symbols e.g.$P = F \div A$	1
(iv)	substitution or re-arrangement; evaluation; e.g. pressure = force ÷ area 400 = force ÷ 0.0017 force = 400 × 0.0017 = 0.68 (N)	substitution and rearrangement in either order allow correctly rounded values e.g. 0.697 allow use of candidate's unrounded value even if not approx 400	2
(v)	upwards force greater than weight of cube; **resultant** force upwards;	allow idea of ice being less dense than water for 1 mark.	2

(Total for Question 4 = 9 marks)

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>5 (a)</td><td>;;;
<table><tr><td colspan="5">Coolest → Hottest</td></tr><tr><td>B</td><td>A</td><td>Sun</td><td>Sirius</td><td>Rigel</td></tr></table></td><td>1 star in correct place scores 1 mark
2 stars in correct places scores 2 marks
3 marks for all stars in correct places

accept colours instead of names
i.e.
red, orange, yellow, white
condone a mix i.e.
Betelgeuse, orange, yellow, Sirius</td><td>3</td></tr>
<tr><td>(b)</td><td>any THREE from

MP1. red supergiant;
MP2. supernova;
MP3. neutron star;
MP4. (or) black hole;</td><td>allow super red giant

2 marks max for any incorrect order including incorrect stages e.g. dust/gas cloud or protostar</td><td>3</td></tr>
<tr><td>(c)</td><td>any pair of readings 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 temp = 10 kK wavelength = 280 nm
$280 \times 10 = 2800$
$140 \times 20 = 2800$
constants are the same so results agree with proposal</td><td>allow ECF for this mark alone

DOP

allow idea that the constants are not the same so that the results do not agree with the conclusion</td><td>4</td></tr>
</table>

(Total for Question 5 = 10 marks)

Question number	Answer	Notes	Marks
6 (a)	any FOUR from: MP1. idea of magnetic field around coil (when current flows); MP2. idea of interaction between fields of magnet and coil; MP3. idea of force on coil from magnet; MP4. idea of alternating force on cone; MP5. cone vibrates; MP6. idea that cone forces air to vibrate; MP7. longitudinal wave formed;	ignore references to induction allow ‘tube’ for ‘cone’ allow idea of series of compressions and rarefactions	4
(b) (i)	substitution; evaluation; correct answer = 0.11 (W) e.g. power = current × voltage = 0.15 × 0.75 power = 0.1125 W	-1 for POT error	2
(ii)	suitable linear scale chosen (>50% of grid used); axes labelled with quantities and units; all plotting correct to nearest half square;	ignore orientation	3
(iii)	attempt at fitting first two points and fitting rest of points separately; single curve with a peak within one large square of third point;	ecf candidate’s plotting max 1 mark for straight line consistent with candidate's plotting	2
(c)	any FOUR from: MP1. for diagram 4, cell voltage no longer shared; MP2. means current through each loudspeaker is doubled; MP3. so current from supply is four times higher; MP4. correct use of ‘R = V/I’; MP5. (so) total resistance is a quarter of that from the series case;	accept voltages in parallel are the same accept voltage is shared in diagram 3 accept idea of current from each branch adds to give total current in cell accept higher order answers in terms of series and parallel equations accept calculation of both circuit’s total resistance	4

(Total for Question 6 = 15 marks)

Question number	Answer	Notes	Marks
7 (a)	idea of radiation from sources in the environment; idea that background is ever present/all around;	allow idea of 'no other sources present'	2
(b) (i)	time taken; and either of for the (radio)activity to halve; for half of the (radioactive) nuclei / atoms/ isotope /mass to decay;	allow "how long it takes" reject "half the time" allow count rate for activity ignore substance	2
(ii)	evidence of graph used correctly; 3.8 (days);	i.e. line drawn across from 600 to curve and down to time axis allow full marks for 3.8-3.85	2
(c)	4 (for alpha nucleon number); 2 (for alpha proton number); 86 (for Rn proton number);	ECF for incorrect alpha proton number then multiplied by 3	3
(d)	any TWO from: MP1. idea of irradiation of internal organs; MP2. alphas are {highly/very/most} ionizing; MP3. causes mutations/cancer;	allow idea that there is no 'dead skin' layer for alphas to penetrate allow 'damages tissue' or 'damages cells/DNA'	2

(Total for Question 7 = 11 marks)

Question number	Answer	Notes	Marks
8 (a) (i)	any FOUR from: MP1. measure mass; MP2. use (mass) balance; MP3. measure diameter; MP4. use ruler/callipers/micrometer; MP5. further experimental detail e.g. use set square against ruler/use callipers in different orientations/fully submerged/avoid splashing; MP6. repeat readings and take average; MP7. use formula to find volume of a sphere e.g. $V = 4/3\ \pi r^3$; MP8. use density = mass ÷ volume;	condone reference to letting the ice melt allow scales reject scale allow use of displacement method and measuring cylinder for MP3, MP4, MP7	4
(ii)	substitution into equation density = mass ÷ volume; evaluation; unit i.e g/cm^3; correct answer = 0.85 g/cm^3 e.g. density = mass ÷ volume density = 0.94 ÷ 1.1 density = 0.8545… density = 0.85 g/cm^3	allow use of standard symbols e.g. D = M ÷ V accept ρ for density -1 for POT error independently marked accept unit matching calculation i.e. if mass converted into kg accept 0.854 or 0.855	3
(b)	any TWO from: MP1. warm **air** rises; MP2. warm **air** expands; MP3. warm air is less dense than cold air; MP4. a convection <u>current</u> is formed;	allow 'cloud' for 'air' allow air particles spread out reject 'particles expand'	2

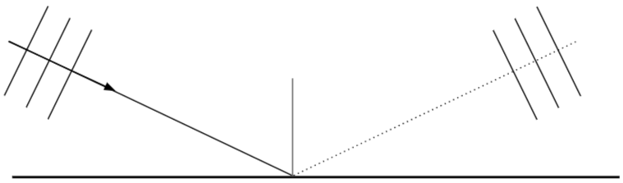
(Total for Question 8 = 9 marks)

Question number	Answer	Notes	Marks
9 (a)	molecules collide with walls; collisions provide force on walls; force per unit area gives a pressure;	allow particles or atoms formula alone is insufficient	3
(b)	any TWO from: MP1. number of molecules in container decreases; MP2. increase in temperature increases speed or KE of molecules; MP3. molecules have a high enough speed or KE to escape;	allow particles or atoms	2
(c)	any TWO from: MP1. idea fewer collisions per unit time gives lower force; MP2. idea that each collision is less hard; MP3. (lower force per unit area gives) lower pressure; MP4. pressure outside container is larger than pressure in can; MP5. pressure difference causes a force;	accept RA throughout accept "lower frequency of collisions" ignore collisions between molecules allow force (from air pressure) is lower inside than outside	2

(Total for Question 9 = 7 marks)

Question number	Answer	Notes	Marks
10 (a) (i)	any THREE from: trolley changes direction; induction depends on direction of relative motion; idea that voltage has changed directon (as sign of voltmeter reading depends on direction of voltage); idea that at ends of motion, voltage is zero;	condone current for voltage ignore idea induction depending on speed	3
(ii)	speed may change/ magnetic field may not be uniform;	accept idea that magnetic field may change allow idea of entering or leaving field	1
(b) (i)	substitution; re-arrangement; evaluation; correct answer: 1.8×10^{-4} (A) e.g. charge = current × time 1.4×10^{-4} = current × 0.78 current = $(1.4 \times 10^{-4}) \div 0.78 = 1.79 \times 10^{-4}$ (A)	substitution and rearrangement in either order -1 POT error	3
(ii)	substitution; re-arrangement; evaluation; correct answer: 1.6×10^{-2} (V) e.g. energy = charge × voltage $2.3 \times 10^{-6} = 1.4 \times 10^{-4}$ × voltage voltage = $(2.3 \times 10^{-6}) \div (1.4 \times 10^{-4}) = 1.64 \times 10^{-2}$ (V)	allow use of standard symbols e.g. $E = Q \times V$ allow v,V for voltage reject C,c for charge substitution and rearrangement in either order -1 POT error	3

(Total for Question 10 = 10 marks)

Question number			Answer	Notes	Marks
11	(a)	(i)	line drawn at 90 degrees to side of boat at point where direction of travel touches boat;	ignore normal inside boat	1
		(ii)	66 (degrees);	accept in range 64-68 degrees	1
		(iii)	three wavefronts parallel and constant wavelength; to the right of the normal and above boat surface; correct angle of reflection; 	by eye; condone different wavelength to incident wavefronts by eye; allow 'reflected ray' if no other mark awarded	3
	(b)	(i)	transverse (waves/particles) vibrate at right angles to the direction of travel of the wave; longitudinal (waves/particles) vibrate along line of direction of travel of the wave;	allow 'vibrations/oscillates at…' allow 'perpendicular to' for 'at right angles' allow 'energy transfer' for 'travel' allow '(anti-)parallel to' for 'along'	2
		(ii)	wavelength or distance between wavefronts smaller; speed **of waves** is constant; reference to wave equation $v = f\lambda$;	if no other marks awarded, 1 mark for reference to Doppler effect	3

(Total for Question 11 = 10 marks)

Question number	Answer	Notes	Marks
12 (a)	use of u=0 (m/s); correct substitution into '$v^2 = u^2 + 2aS$'; correct evaluation of v^2; correct evaluation of v; correct answer = 160 (m/s) e.g. $v^2 = u^2 + 2aS$ $v^2 = 0^2 + (2 \times 10 \times 1300)$ $v^2 = 26000$ v = 161.245... (m/s)	accept loss of GPE = gain in KE reject use of v=0 for this MP $v^2 = 26000$ accept 25506, 25480 reject $v^2 = 2600$ if no a=10 seen. ignore sign accept 159.7059..,159.62....	4
(b) (i)	any THREE from: MP1. reference to weight **and** air resistance; MP2. air resistance larger than weight (when parachute opens); MP3. reference to 'F = ma'; MP4. acceleration is upwards; MP5. air resistance decreases as parachutist slows down;	ignore 'upthrust' accept drag for AR accept 'resultant or unbalanced force is upwards ' allow idea of increased AR ignore 'decelerates' or 'slows down'	3
(ii)	any THREE from: MP1. GPE reduces as height above ground reduces; MP2. KE reduces as speed reduces; MP3. friction force does mechanical work on parachutist; MP4. thermal store of parachutist increases; MP5. thermal transfer between (warm) parachutist and (cold) air; MP6. thermal transfer happens by conduction or radiation;	accept 'works mechanically' accept 'energy lost to the surroundings' accept idea of conversion to heat energy via friction	3

(Total for Question 12 = 10 marks)

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