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Pearson Edexcel

Mark Scheme (Results)

January 2021

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

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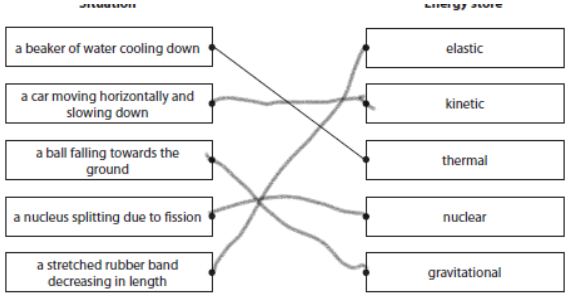
Question number	Answer	Notes	Marks
1 (a)		-1 for each additional line	4
(b) (i)	A - electrical;		1
(ii)	B - light radiation;		1

(Total for Question 1 = 6 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>
<table>
<tr><th>thermometer</th><th>part of spectrum</th></tr>
<tr><td>P</td><td>infrared;</td></tr>
<tr><td>Q</td><td>red</td></tr>
<tr><td>R</td><td>green / yellow;</td></tr>
<tr><td>S</td><td>violet</td></tr>
<tr><td>T</td><td>ultraviolet;</td></tr>
</table>
</td><td>allow all valid colours/ visible</td><td>3</td></tr>
<tr><td>(b)</td><td>any reference to absorption;

black is the better/best/good absorber;</td><td>allow reference to reflection
allow reference to ‘poor reflector’</td><td>2</td></tr>
<tr><td>(c)</td><td>infrared/IR;</td><td></td><td>1</td></tr>
</table>

(Total for Question 2 = 6 marks)

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Question number	Answer	Notes	Marks
3 (a)	planet;		1
(b)	comet;	accept planet	1
(c)	substitution into given formula; conversion of 35 days into seconds; evaluation; e.g. $v = 2 \times \pi \times 1.5 \times 10^{11}/(35 \times 24 \times 60 \times 60)$ $v = 310\,000$ m/s	 allow full credit for 2.6927937×10^{10} if unit changed to m/day. 311665.93(7)8 Answer for incorrect/no conversion of days→ seconds 2.69etc x 10^{10} scores 2 -1 for POT error	3

(Total for Question 3 = 5 marks)

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Question number	Answer	Notes	Marks
4 (a)	idea that not doing so means impossible to tell what change caused the change in the dependent;	allow idea of a 'fair test' ignore references to accuracy, reliability	1
(b) (i)	straight line; (line) does not go through origin;	condone linear	2
(ii)	given line extrapolated to x-axis; -300 °C;	accept in range –320 to -280 degrees C	2
(iii)	any THREE from: MP1 (increase in temperature) increases speed/KE; MP2 collisions between walls and particles more frequent/eq; MP3 idea collisions between walls and particles are harder; MP4 idea that force (between wall and particle) is increased; MP5 P=F/A so increased force means increased pressure for same area.		3
(c) (i)	conversion of both temperatures to kelvin scale; substitution; rearrangement; evaluation; e.g. 35 °C and 340 °C→ 308 and 613 K 112 (kPa)/308 = P / 613 P = 613 × 112 / 308 P = 220 (kPa)	-1 for POT error accept 222.909… accept 1088 (kPa) for 2 marks (no conversion of temperature)	4
(ii)	number of {particles/moles/mass/molecules} of gas	accept type of gas	1

(Total for Question 4 = 13 marks)

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Question number	Answer	Notes	Marks
5 (a)	any attempt at finding the area/ "area = distance" stated; area of triangle = ½ x 4.3 x 0.2 (= 0.43 m); area of rectangle = 4.3 x 0.2 (= 0.86 m); distance = 1.29 (m) ;	 accept area of trapezium = ½ x 4.3 x (0.2 + 0.4) for MP2 and MP3. count squares; area of 1 square = 0.001 (m); distance = 1.29 (m)	4

(b) (i)	idea that acceleration = gradient;
	gradient = (-)4.3 / 0.05;
	acceleration = (-) 86 (m/s^2);
		
		-1 for POT error
			3

(ii)	(resultant) force = mass x acceleration / F = ma		1
(iii)	substitution; evaluation; eg F = 0.13 x 86 F = 11 (N)	 allow ECF from (i) ignore sign 11.18, 11.2	2
(c)	increases time of collision; any reference to shallower gradient on graph; so acceleration will be smaller (in magnitude);		3

(Total for Question 5 = 13 marks)

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Question number	Answer	Notes	Marks
6 (a)	17 (degrees);	Allow in range 15-19 degrees	1
(b)	refractive index = sin(i) / sin (r);	accept n or η for refractive index accept any valid rearrangement	1
(c)	substitution; evaluation of either sine correctly; evaluation; e.g. refractive index = sin(29)/sin(17) refractive index = 0.484…/0.292… refractive index = 1.7	allow ecf from (a) 0.48480962/0.292371705 1.6581961	3

(Total for Question 6 = 5 marks)

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Question number	Answer	Notes	Marks
7 (a) (i)	as pressure increases, volume decreases; pattern statement relating to gradient; e.g. 'at a decreasing rate'	ORA 'inversely proportional' scores 2 marks.	2
(ii)	pressure = depth × gravitational field strength × density;	allow recognised symbols e.g. P or p for pressure d or h for depth ρ for density reject d for density, reject gravity for g	1
(iii)	substitution; evaluation; e.g. pressure = 0.22 × 10 × 1080 pressure = 2 400 (Pa)	Accept use of g=9.8(1) (N/kg) 2376 (Pa) -1 for POT error provided *g* is used	2
(iv)	103 000 (Pa)	accept 103 400 (Pa) allow ECF	1
(v)	substitution into given formula; rearrangement; evaluation; e.g $p_1 \times V_1 = p_2 \times V_2$ 101 000 × 0.084 = 103 000 x V_2 V_2 = 0.082 (cm^3)	allow ECF from (iv) e.g. 98624 gives 0.086 (cm^3) 0.082368932 -1 for POT error	3
(b)	vertical arrow upwards labelled upthrust; vertical arrow downwards labelled weight; upthrust > weight;	 ignore drag reject this mark if there are more than two arrows	3

(Total for Question 7 = 12 marks)

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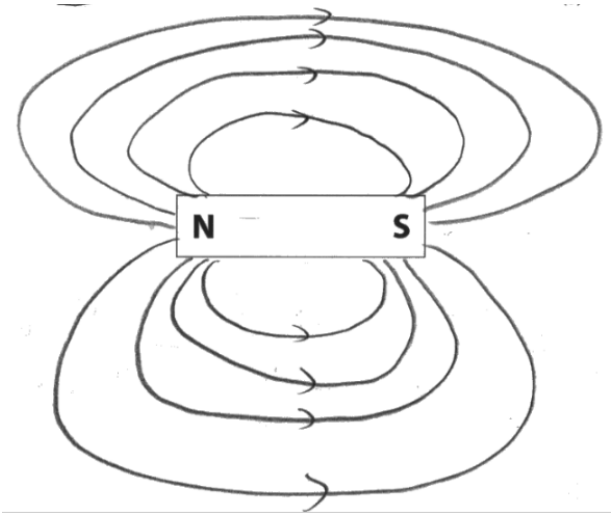
Question number	Answer	Notes	Marks
8 (a)	at least four lines leaving/entering poles; at least one loop 'above' and one loop 'below'; arrowheads on at least four lines which are self-consistent;  	accept part loops ignore field lines that cross	3
(b)	idea of wire cutting field lines; idea of an **induced** voltage;	allow higher order ideas involving flux linkage	2

(Total for Question 8 = 5 marks)

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Question number	Answer	Notes	Marks
9	Any FIVE from: MP1 reference to Doppler effect; MP2 wavefronts are emitted at constant frequency by buzzer; MP3 wavefronts arrive at student (A) further apart than when they were emitted; MP4 distance between wavefronts is the wavelength; MP5 speed = frequency × wavelength; MP6 speed of waves is constant; MP7 as speed is constant and wavelength has increased, frequency must decrease; MP8 decrease in frequency is experienced as a decrease in pitch;	Allow 'wavelength increases' if MP3 or MP4 not awarded	5

(Total for Question 9 = 5 marks)

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Question number	Answer	Notes	Marks
10 (a)	236 – (97 + 135); x = 4;	answer of 4 scores 2	2
(b)	(fission) releases neutrons; neutrons can be captured by other uranium **nuclei**; (these nuclei) then undergo fission;		3
(c)	evidence of halving of 72 (kBq); evidence of four half-lives required; e.g. count rate after 4 half-lives is 4.5 (kBq) evidence that four half-lives is equivalent to 60 million years;		3
(d)	Any FIVE from: MP1 Idea of strong containers; MP2 idea that containers can't rust; MP3 idea that rust-proof containers expensive/difficult to manufacture; MP4 reference to security of waste site; MP5 reference to dilution in sea water; MP6 reference to leakage into water table;	accept idea of a location that prevents rust accept low earthquake risk	5

(Total for Question 10 = 13 marks)

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Question number	Answer	Notes	Marks
11 (a) (i)	work done = force × distance (travelled);	allow accepted symbols	1
(ii)	substitution; evaluation; e.g work done = 0.89 × 26 work done = 23.1(4 J)		2
(iii)	evidence of recall of formula GPE = mgh; substitution; evaluation; e.g. GPE = mgh GPE = 1.3 × 10 × 0.11 GPE = 1.4(3 J)	allow g = 9.8(1) (N/kg) -1 for POT error providing use of *g* seen	3
(iv)	any TWO from: any reference to friction/air resistance; energy transferred to the surroundings (by mechanical work); block not necessarily at constant speed;	allow 'heat/thermal energy transferred to air/ramp by friction for 2 marks	2
(b)	any TWO from: lower force required; to prevent block from slipping down required / to move block; any TWO from: longer distance required (with a lower force); more inefficient; greater proportion of energy transferred to the surroundings;	allow 'to overcome friction' allow 'easier to move block' for 2 marks Allow idea of more work required (for same increase in GPE)	4

(Total for Question 11 = 12 marks)

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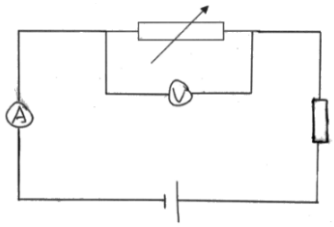
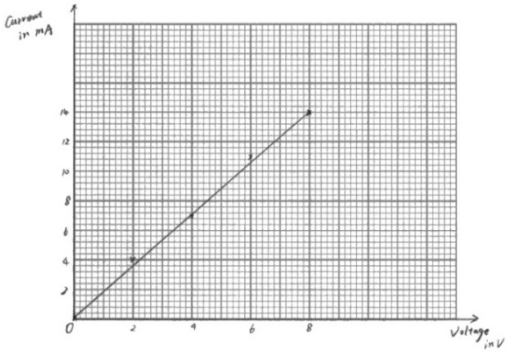
Question number	Answer	Notes	Marks
12 (a) (i)	correct symbol for resistor; correct symbol for cell; correct symbol for ammeter; circuit is complete series circuit;  	reject extra components allow ECF for missing/incorrect symbols	4
(ii)	voltmeter symbol is correct and in parallel with any component; voltmeter is in parallel with variable resistor;		2
(b)	any FOUR from: stretchy resistor increases in resistance (when mass increased); total resistance increases; I = V/R; current in circuit less; voltage across fixed resistor decreases; so voltage across stretchy resistor increases; as total voltage is constant/voltage of cell constant;	reject V=IR or I=V/R with assumption of constant current	4
(c) (i)	voltage;	allow 'V'	1
(ii)	suitable linear scale chosen (>50% of grid used); axes labelled with quantities and unit; all plotting correct to nearest half square;  	ignore orientation	3
(iii)	correct best fit line judged by eye;		1

(Total for Question 12 = 15 marks)

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