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Mark Scheme (Results)

January 2020

Pearson Edexcel International GCSE
in Physics (4PH1)
Paper 2PR

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January 2020
Publications Code 4PH1_2PR_msc_20200305
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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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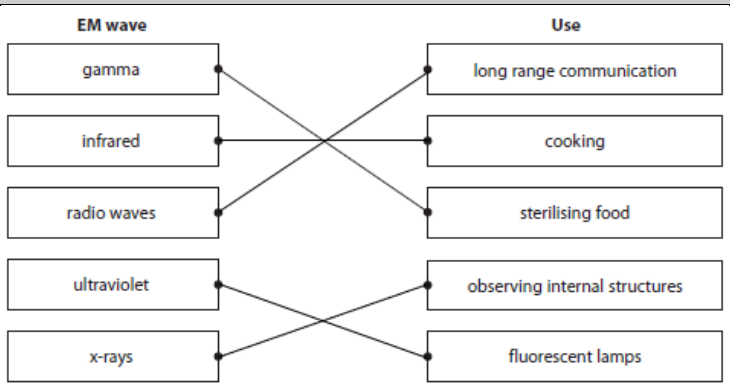
Question number	Answer	Notes	Marks
1 (a)	 all four correct;;;	gamma use is given so only judge other four EM waves for marks three or two correct scores 2 marks one correct scores 1 mark	3
(b)	C (internal heating of tissue); A is incorrect because this is a hazard of visible and ultraviolet radiation B is incorrect because this is a hazard of x-ray and gamma radiation D is incorrect because this is a hazard if infrared radiation		1
(c)	radio (waves);		1

Total for Question 1 = 5 marks

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Question number	Answer	Notes	Marks
2 (a)	centre of gravity;	accept centre of mass	1
(b)	moment = force × (perpendicular) distance;	allow standard symbols and rearrangements e.g. M = F × d allow d, s, x for distance	1
(c)	substitution; rearrangement; evaluation; e.g. 92 = F_s × 0.84 F_s = 92 / 0.84 (F_s =) 110 (N)	 -1 for POT error 2 marks max. if incorrect distance used e.g. 0.42 m giving answer of 219 (N) allow 109.5, 109.52…	3
(d)	idea that every force has an equal and opposite reaction;	however expressed allow “action” for force	1
(e)	same value as (c); down;	allow ecf from (c) expected answer is 110 (N)	2

Total for Question 2 = 8 marks

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Question number	Answer	Notes	Marks
3 (a)	momentum = mass × velocity;	allow standard symbols and rearrangements e.g. $p = m \times v$ reject M, m for momentum	1
(b)	substitution; evaluation; unit; e.g. $p = 1.67 \times 10^{-27} \times 2200$ (p =) 3.7×10^{-24} kg m/s	 allow $3.6(74) \times 10^{-24}$ allow 3.7×10^{-21} g m/s for 3 marks	3
(c)	(total) momentum before (collision) = (total) momentum after (collision);		1
(d)	evaluation of momentum of U-235 before collision; addition of neutron momentum; rearrangement to give velocity of U-236; correct evaluation; e.g. $p_{U\text{-}235} = (3.99 \times 10^{-25} \times 10 =) \ 3.99 \times 10^{-24}$ $p_{U\text{-}236} = 3.99 \times 10^{-24} + 3.7 \times 10^{-24}$ $v_{U\text{-}236}$ = momentum / mass = $7.664 \times 10^{-24} / 4.01 \times 10^{-25}$ ($v_{U\text{-}236}$ =) 19 (m/s)	 allow ecf from (b) seen or implied by working not adding neutron momentum gives 9.95 m/s = 2 marks allow 19.1… (m/s)	4

Total for Question 3 = 9 marks

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Question number	Answer	Notes	Marks
4 (a) (i)	substitution; evaluation; e.g. (GPE =) 1.8 × 10 × 0.95 (GPE =) 17 (J)	allow g = 9.8, 9.81 allow 16.8, 16.7…, 17.1… (J)	2
(a) (ii)	idea that KE (gained) is greater than GPE (lost); idea KE gained = GPE lost + work done; e.g. 17 + 4 = 21 OR 21 – 17 = 4		2
(b) (i)	use of KE = ½ × mass × speed^2; substitution; rearrangement; evaluation; e.g. KE = ½ × m × v^2 21 = 0.5 × 1.8 × v^2 v = √(21/0.9) (v =) 4.8 (m/s)	allow standard symbols can be implied from working allow 4.83, 4.83… (m/s)	4
(ii)	substitution into F = mv-mu / t; evaluation; e.g. F = (1.8 × 4.8) / 0.12 (F =) 72 (N)	allow ecf from (b)(i) allow alternative method using a = (v-u)/t and F = ma allow 72.5, 72.45… (N)	2

Total for Question 4 = 10 marks

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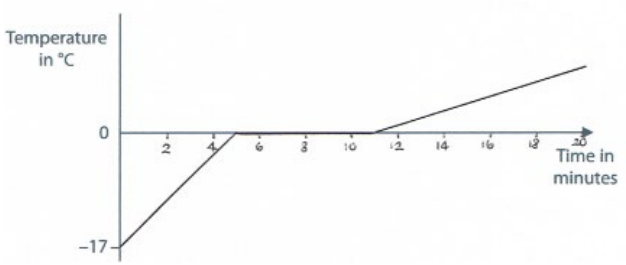
Question number	Answer	Notes	Marks
5 (a) (i)	line starts at (0,-17) and rises to steady temperature of 0 °C (after 5 minutes); 6 minutes along time axis at temperature of 0 °C; line drawn showing increase in temperature from 0 °C until 20 minutes on time axis;  	allow candidate's time axis scale or clearly marked times line can be curved or straight ignore start and end times as long as duration is 6 minutes line can be curved or straight and can end at any temperature	3
(ii)	any one from: • keep heater submerged; • (check) voltage remains constant; • idea of not removing lid; • stirring (once some ice has melted); • repeat and average;	ignore using more insulation, digital thermometer allow idea that lid is well sealed allow repeat and remove anomalies	1
(b)	dimensionally correct substitution into $\Delta Q = m \times c \times \Delta T$; rearrangement; evaluation; e.g. $2500 = 0.048 \times 880 \times \Delta T$ $\Delta T = 2500 / (0.048 \times 880)$ (ΔT =) 59 (°C)	allow mass in kg or g for this mark seen or implied from working -1 for POT error final answer of 42 = 2 marks allow 59.2, 59.18… (°C) condone 59.1 (°C)	3

Total for Question 5 = 7 marks

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Question number	Answer	Notes	Marks
6 (a) (i)	$\frac{\text{input voltage}}{\text{output voltage}} = \frac{\text{primary turns}}{\text{secondary turns}}$;	allow standard symbols and rearrangements e.g. $V_p / V_s = N_p / N_s$ allow T, n for turns allow 1,2 in,out for p and s	1
(ii)	substitution; rearrangement; evaluation; e.g. $15/330 = 2600/N_s$ $N_s = 2600 \times 330 / 15$ $N_s = 57\,000$	allow kV or V for voltages -1 for POT error allow 57 200	3
(b)	any four from: MP1. step-up transformer increases voltage; MP2. step-up transformer decreases current; MP3. idea that $P_{in} = P_{out}$ / $V_{in}I_{in}=V_{out}I_{out}$ (assuming 100% efficient); MP4. idea that transmission current is reduced; MP5. idea that energy losses are reduced; MP6. (because) current causes heating (in transmission cables); MP7. idea that step-down transformer used to reduce voltage to safe level;	credit ideas seen in diagram allow RA allow RA allow increasing the voltage decreases the current allow heating losses reduced	4

Total for Question 6 = 8 marks

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Question number	Answer	Notes	Marks
7 (a)	opposite poles facing; held (very) close together;	 reject if magnets described as touching	2
(b) (i)	arrow directed towards the centre of the circle in line with the position of the proton;	judge by eye condone arrow that does not originate at the position of the proton	1
(ii)	correct diameter given to 1 significant figure = 1 mark; correct diameter given to 2 or 3 significant figures = 2 marks;;	6 (cm) 5.8-6.1 (cm)	2
(iii)	use of radius; dimensionally correct substitution into $v = 2 \times \pi \times r / T$; evaluation; e.g. r = (6.0 / 2 =) 3.0 cm $v = 2 \times \pi \times 0.030 / 8.7 \times 10^{-6}$ (v =) 22 000 (m/s)	allow ecf from (b)(ii) -1 for POT error accept alternative method using $v = \pi \times d / T$ allow 21 000-22 000 (m/s)	3

Total for Question 7 = 8 marks

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Question number	Answer	Notes	Marks
8 (a) (i)	buzzer B travels **twice** the distance; in the same time (period) OR (average) speed = distance/time taken;	ignore quoting distances since given in question	2
(ii)	any three from: MP1. frequency decreases; MP2. due to Doppler effect; MP3. idea of increased wavelength; MP4. idea that **decrease** in frequency of buzzer B is twice that of buzzer A;	 allow for either / both buzzer(s) reject if one frequency said to be increased allow idea of waves behind buzzers being more spread out reject if one wavelength said to be decreased allow frequency of buzzer B being lower than frequency of buzzer A / ORA	3
(b)	determination of number of squares for one period; correct use of oscilloscope settings; evaluation in standard form; e.g. period = 4 squares (period = 4) × 0.002 (period =) 8×10^{-3} (s)	 seen anywhere in working award 2 marks for answers of 4×10^{-3}, 16×10^{-3} (s)	3
(c) (i)	10 (nm);		1
(ii)	idea the speed of Q is double the speed of P;	allow greater speed	1
(iii)	20 (nm);	allow ecf from (c)(i)	1
(iv)	any four from: MP1. further / faster galaxy (Q) shows greater red shift; MP2. further galaxy (Q) is travelling faster; MP3. (which suggests) universe is expanding; MP4. idea that at an earlier point in time; MP5. the universe was a single point;	 allow use of phrases such as “originated” / eq.	4

Total for Question 8 = 15 marks

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