



## Mark Scheme (Results)

January 2020

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

| Question number | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Notes                                                                                                                                          | Marks |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1 (a)           | <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p style="text-align: center;"><b>EM wave</b></p> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">gamma</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">infrared</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">radio waves</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">ultraviolet</div> <div style="border: 1px solid black; padding: 2px;">x-rays</div> </div> <div style="width: 45%;"> <p style="text-align: center;"><b>Use</b></p> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">long range communication</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">cooking</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">sterilising food</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;">observing internal structures</div> <div style="border: 1px solid black; padding: 2px;">fluorescent lamps</div> </div> </div> <p>all four correct;;;;</p> | <p>gamma use is given so only judge other four EM waves for marks</p> <p>three or two correct scores 2 marks<br/>one correct scores 1 mark</p> | 3     |
| (b)             | <p>C (internal heating of tissue);</p> <p>A is incorrect because this is a hazard of visible and ultraviolet radiation<br/>B is incorrect because this is a hazard of x-ray and gamma radiation<br/>D is incorrect because this is a hazard of infrared radiation</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                | 1     |
| (c)             | radio (waves);                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                | 1     |

Total for Question 1 = 5 marks

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

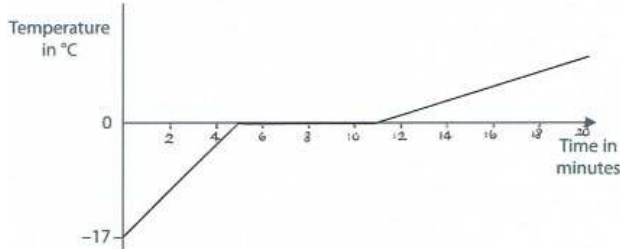
Total for Question 2 = 8 marks

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

Total for Question 3 = 9 marks

| Question number | Answer                                                                                                                                                                                                                                                         | Notes                                                                                                                            | Marks |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|-------|
| 4 (a) (i)       | substitution;<br>evaluation;<br><br>e.g.<br>(GPE =) $1.8 \times 10 \times 0.95$<br>(GPE =) 17 (J)                                                                                                                                                              | allow $g = 9.8, 9.81$<br><br>allow 16.8, 16.7..., 17.1... (J)                                                                    | 2     |
| (a) (ii)        | idea that KE (gained) is greater than GPE (lost);<br>idea KE gained = GPE lost + work done;<br>e.g. $17 + 4 = 21$ OR $21 - 17 = 4$                                                                                                                             |                                                                                                                                  | 2     |
| (b) (i)         | use of $KE = \frac{1}{2} \times \text{mass} \times \text{speed}^2$ ;<br><br>substitution;<br>rearrangement;<br>evaluation;<br><br>e.g.<br>$KE = \frac{1}{2} \times m \times v^2$<br>$21 = 0.5 \times 1.8 \times v^2$<br>$v = \sqrt{21/0.9}$<br>(v =) 4.8 (m/s) | allow standard symbols<br>can be implied from<br>working<br><br>allow 4.83, 4.83... (m/s)                                        | 4     |
| (ii)            | substitution into $F = mv - mu / t$ ;<br>evaluation;<br><br>e.g.<br>$F = (1.8 \times 4.8) / 0.12$<br>(F =) 72 (N)                                                                                                                                              | allow ecf from (b)(i)<br><br>allow alternative<br>method using<br>$a = (v - u) / t$ and $F = ma$<br><br>allow 72.5, 72.45... (N) | 2     |

Total for Question 4 = 10 marks

| Question number | Answer                                                                                                                                                                                                                                                                                                                         | Notes                                                                                                                                                                                                                                    | Marks |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 5 (a) (i)       | <p>line starts at (0,-17) and rises to steady temperature of 0 °C (after 5 minutes);<br/>6 minutes along time axis at temperature of 0 °C;</p> <p>line drawn showing increase in temperature from 0 °C until 20 minutes on time axis;</p>     | <p>allow candidate's time axis scale or clearly marked times<br/>line can be curved or straight</p> <p>ignore start and end times as long as duration is 6 minutes<br/>line can be curved or straight and can end at any temperature</p> | 3     |
| (ii)            | <p>any one from:</p> <ul style="list-style-type: none"> <li>• keep heater submerged;</li> <li>• (check) voltage remains constant;</li> <li>• idea of not removing lid;</li> <li>• stirring (once some ice has melted);</li> <li>• repeat and average;</li> </ul>                                                               | <p>ignore using more insulation, digital thermometer</p> <p>allow idea that lid is well sealed</p> <p>allow repeat and remove anomalies</p>                                                                                              | 1     |
| (b)             | <p>dimensionally correct substitution into <math>\Delta Q = m \times c \times \Delta T</math>;<br/>rearrangement;<br/>evaluation;</p> <p>e.g.<br/> <math>2500 = 0.048 \times 880 \times \Delta T</math><br/> <math>\Delta T = 2500 / (0.048 \times 880)</math><br/> <math>(\Delta T =) 59 \text{ (}^\circ\text{C)}</math> </p> | <p>allow mass in kg or g for this mark<br/>seen or implied from working<br/>-1 for POT error</p> <p>final answer of 42 = 2 marks</p> <p>allow 59.2, 59.18... (°C)<br/>condone 59.1 (°C)</p>                                              | 3     |

Total for Question 5 = 7 marks

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

Total for Question 6 = 8 marks

| Question number | Answer                                                                                                                                                                                                                                       | Notes                                                                                                                                           | Marks |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 7 (a)           | opposite poles facing;<br>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<br><br>condone arrow that does not originate at the position of the proton                                                         | 1     |
| (ii)            | correct diameter given to 1 significant figure = 1 mark;<br>correct diameter given to 2 or 3 significant figures = 2 marks;;                                                                                                                 | 6 (cm)<br><br>5.8-6.1 (cm)                                                                                                                      | 2     |
| (iii)           | use of radius;<br>dimensionally correct substitution into $v = 2 \times \pi \times r / T$ ;<br>evaluation;<br><br>e.g.<br>$r = (6.0 / 2) = 3.0 \text{ cm}$<br>$v = 2 \times \pi \times 0.030 / 8.7 \times 10^{-6}$<br>( $v =$ ) 22 000 (m/s) | allow ecf from (b)(ii)<br><br>-1 for POT error<br>accept alternative method using<br>$v = \pi \times d / T$<br><br>allow<br>21 000-22 000 (m/s) | 3     |

Total for Question 7 = 8 marks



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

Total for Question 8 = 15 marks