Mark Scheme (Results)

January 2022

Pearson Edexcel International GCSE

In Physics (4PH1) Paper 2PR

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>1 (a) (i)</td><td>each tick correctly placed in each row;;;;

<table><tr><th></th><th colspan="4">Energy store</th></tr><tr><th>Method of generating electricity</th><th>Thermal</th><th>Gravitational potential</th><th>Kinetic</th><th>Chemical</th></tr><tr><td>Geothermal power station</td><td>✓</td><td></td><td></td><td></td></tr><tr><td>Hydroelectric power station</td><td></td><td>✓</td><td></td><td></td></tr><tr><td>Petrol generator</td><td></td><td></td><td></td><td>✓</td></tr><tr><td>Wind turbine</td><td></td><td></td><td>✓</td><td></td></tr></table></td><td>more than one tick in a row negates the mark</td><td>4</td></tr>
<tr><td>(ii)</td><td>petrol generator;</td><td></td><td>1</td></tr>
<tr><td>(b)</td><td>any two from:

MP1. idea of noise pollution;
MP2. idea of visual pollution;
MP3. idea that turbine only generates electricity when the wind blows;
MP4. difficult for output to match demand;

MP5. wind is a dilute source of energy;

MP6. can cause harm to migrating flocks of birds;</td><td>ignore statements relating to cost
ignore bald ‘pollution’
ignore bald ‘pollution’

ignore ‘do not generate much electricity/energy’
allow idea that wind farms take up a lot of space</td><td>2</td></tr>
</table>

Total for Question 1 = 7 marks

Question number	Answer	Notes	Marks
2 (a) (i)	substitution into F = (mv – mu)/t; evaluation; correct direction; e.g. (F =) (6.7 - −4.2) / 0.012 (F =) 910 (N) (direction =) right	 -1 if POT error independent mark 208.3… scores 2 marks max. if given with correct direction allow 908.3…(N) allow forwards ignore compass directions 0.9083… scores 1 mark	3
(ii)	same forces as in (a)(i) AND <u>opposite</u> direction; e.g. (F =) 910 (N) AND (direction =) left	allow ECF from (a)(i) for both points allow ECF for compass direction only if opposite to direction given in (i)	1
(b)	any three from: MP1. idea that there is a change of momentum (when ball hits player); MP2. (equipment) increases (impact) time; MP3. decreases rate of change of momentum (of ball); MP4. decreases force (on player); MP5. decreases pressure (on player);	 allow spreads force over larger area	3

Total for Question 2 = 7 marks

Question number	Answer	Notes	Marks
3 (a)	any five from:	allow alternative approach using echoes from a wall	5
	MP1. idea that students stand a **large** distance apart;	allow stated distance if 50m or greater allow a large distance from a wall (at least 25m)	
	MP2. measure distance with tape measure / trundle wheel;	ignore ruler	
	MP3. start timing when see blocks hit together;	allow idea of setting of a rhythm if wall method used	
	MP4. stop timing when hear sound from blocks being hit together;	allow dividing total time by number of hits if wall method used	
	MP5. measure time with stopclock / stop watch;	ignore timer	
	MP6. take repeats and determine mean;	allow take repeats to identify anomalies	
	MP7. use of speed = distance / time;	allow use of speed = 2×distance / time if wall method used	
	MP8. use of a distance-time graph to find speed from gradient;		
(b) (i)	mean calculated correctly; expressed to 2 decimal places; e.g. (mean time =) 0.866… (s) (mean time =) 0.87 (s)	 DOP 0.86 scores 1 mark only	2
(ii)	idea of ignoring or repeating the anomaly;	ignore ‘repeat the experiment’	1
(iii)	300m distance chosen; idea that reaction time is likely to be less significant at greater distances;	allow greatest distance allow 200m only if justified with a speed of sound argument allow idea that it gives a speed closest to the true value allow idea that readings from trials show least variation	2

Total for Question 3 = 10 marks

Question number	Answer	Notes	Marks
4 (a)	substitution into P = E / t; rearrangement; evaluation; e.g. $1.2 \times 10^5 = 4.0 \times 10^6$ / time (time =) $4.0 \times 10^6 / 1.2 \times 10^5$ (time =) 33 (s)	 -1 for POT error allow 33.3…	3
(b) (i)	idea that current only passes (a point) in one direction;	allow does not change direction	1
(ii)	any three from: MP1. provides a connection / current to the coil / commutator; MP2. idea of reverses the current in the coil; MP3. every half turn; MP4. reverses (coil) field / polarity / force (every half turn); MP5. so that force is always in the same direction; MP6. so that the motor keeps turning (the same way);	 allow idea of swapping the contacts allow moment for force	3
(c) (i)	chemical;	allow thermal / heat	1
(ii)	idea of conservation of energy; idea that energy is transferred (from kinetic store of car); to chemical store (of battery pack);	allow “energy can’t be created or destroyed” / eq allow energy transferred electrically	3

Total for Question 4 = 11 marks

Question number	Answer	Notes	Marks
5 (a) (i)	neutron / n;		1
(ii)	correct evaluation; given to 1s.f.; e.g. (number =) $3.3\ldots \times 10^{11}$ (number =) 3×10^{11}	 independent mark	2
(iii)	any three from: MP1. nuclei move (too) slowly at low temperature; MP2. nuclei interact/collide less often at low temperature; MP3. nuclei repel each other; MP4. nuclei cannot get close enough / don't have chance to undergo fusion;	allow RA in terms of high temperature/pressure allow atoms/particles/hydrogen for nuclei allow nuclei not having enough KE allow less chance of collisions	3
(b) (i)	nucleus must be moving; downwards;	allow travelling for moving reject if implication that movement is caused by the force	2
(ii)	increase magnetic field strength / increase speed of nucleus / increase temperature of reactor;	allow use stronger magnets	1

Total for Question 5 = 9 marks

Question number	Answer	Notes	Marks
6 (a)	a (large) collection of (billions of) stars;	allow solar systems for stars	1
(b)	D (the universe); A is not the correct answer because a nebula is a gas cloud B is not the correct answer because a red giant is a star C is not the correct answer because a solar system consists of a star and planets		1
(c) (i)	galaxy A is moving towards Earth; galaxy B is moving away from Earth; galaxy B is moving faster than galaxy A;	allow 1 mark for galaxies moving in opposite directions if neither of these marks scored	3
(ii)	correct evaluation of $\Delta\lambda$; substitution into $\Delta\lambda/\lambda = v/c$; rearrangement; evaluation; $\Delta\lambda = (657.81 - 656.45 =) 1.36$ (nm) $1.36/656.45 = v/3\times10^8$ $(v =) 1.36 \times 3\times10^8 / 656.45$ (v =) 620 000 (m/s)	allow ECF from incorrect $\Delta\lambda$ if clear from working can be in nm or m -1 if 657.81 used as λ allow 3 marks max. if galaxy A used, giving v = 109 681… 729 693…, 731 473… score 2 marks 620 239 etc. scores 3 marks allow 621 524 etc.	4

Total for Question 6 = 9 marks

Question number	Answer	Notes	Marks
7 (a)	attempt to draw tangent to the curve at 70°C; attempt at finding gradient of tangent; correct evaluation of gradient; final answer given as negative; e.g. tangent seen on graph at 70°C gradient = [57-79]/600 gradient = −0.037 (°C/s)	 allow range of 0.030-0.045 independent mark	4
(b)	curve drawn of similar shape to original starting at 82 °C; curve drawn above original;		2

Total for Question 7 = 6 marks

Question number	Answer	Notes	Marks
8 (a) (i)	idea that the dome loses electrons;	however expressed reject if idea that positive charge has been transferred	1
(ii)	substitution into $E = V \times I \times t$; rearrangement; evaluation; e.g. $0.50 = 120\,000 \times I \times 15$ $I = 0.50 / [120\,000 \times 15]$ $(I =) 2.8 \times 10^{-7}$ (A)	ignore units -1 for POT error allow 0.000 000 277…(A) condone 2.7×10^{-7} (A)	3
(b) (i)	any three from: MP1. metal case loses electrons; MP2. (because) metal case is a conductor; MP3. dome and metal case have the same charge; MP4. repulsion between dome and metal case;	 allow metal case becomes (positively) charged	3
(ii)	any four from: MP1. repulsive force from dome decreases as separation increases; MP2. named downward force e.g. weight, air resistance acts on the case; MP3. (eventually, resultant) downwards force acts on case; MP4. causing the case to slow down; MP5. kinetic energy decreases; MP6. gravitational potential energy increases; MP7. kinetic energy becomes zero (at maximum height);	 allow speed becomes zero	4

Total for Question 8 = 11 marks