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Mark Scheme (Results)

January 2022

Pearson Edexcel International GCSE

In Physics (4PH1) Paper 2PR

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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) (i)	each tick correctly placed in each row;;;;	more than one tick in a row negates the mark	4
(ii)	petrol generator;		1
(b)	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;	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	2

	Energy store			
Method of generating electricity	Thermal	Gravitational potential	Kinetic	Chemical
Geothermal power station	✓			
Hydroelectric power station		✓		
Petrol generator				✓
Wind turbine			✓	

Total for Question 1 = 7 marks

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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

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Question number	Answer	Notes	Marks
3 (a)	any five from: MP1. idea that students stand a **large** distance apart; MP2. measure distance with tape measure / trundle wheel; MP3. start timing when see blocks hit together; MP4. stop timing when hear sound from blocks being hit together; MP5. measure time with stopclock / stop watch; MP6. take repeats and determine mean; MP7. use of speed = distance / time; MP8. use of a distance-time graph to find speed from gradient;	allow alternative approach using echoes from a wall allow stated distance if 50m or greater allow a large distance from a wall (at least 25m) ignore ruler allow idea of setting of a rhythm if wall method used allow dividing total time by number of hits if wall method used ignore timer allow take repeats to identify anomalies allow use of speed = 2×distance / time if wall method used	5
(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

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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

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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

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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

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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; <u>curve</u> drawn above original;		2

Total for Question 7 = 6 marks

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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 =) 2.8×10^{-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

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