Pearson Edexcel

Mark Scheme (final)

Summer 2019

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.

Question number	Answer	Notes	Marks
1 (a) (i)	(crude) oil / coal / (natural) gas;	allow petrol / diesel / gasoline / kerosene	1
(ii)	B – (furnace and boiler); A is incorrect because this transfers energy between thermal stores C is incorrect because this transfers energy electrically from a kinetic store D is incorrect because this transfers energy from a thermal to a kinetic store		1
(iii)	C – (generator); A is incorrect because this transfers energy between thermal stores B is incorrect because this transfers energy from a chemical to a thermal store D is incorrect because this transfers energy from a thermal to a kinetic store		1
(b)	any **two** advantages **max.** from: MP1. solar is renewable; MP2. no fuel / transportation cost; MP3. no air pollution / greenhouse gases; any **two** disadvantages **max.** from: MP4. idea that Sun does not shine all the time; MP5. idea that output depends on geographical location; MP6. need for large open spaces;	 allow "sunlight is free"/eq allow named pollutant e.g. CO_2 etc. ignore comments relating to setup cost ignore "relies on the weather" allow "takes up farm land"/eq	4

Total for Question 1 = 7 marks

Question number	Answer	Notes	Marks
2 (a)	longitudinal;		1
(b) (i)	particles **arranged** randomly; particles further apart in gas than in liquid;	allow either mark if clear from diagrams allow irregularly for randomly mark can be given for description of liquid, gas, or both allow RA ignore diagram for this mark if gaps in liquid bigger than one particle	2
(ii)	(sound travels by) vibrations; idea that {vibrations / sound / waves / energy} are passed on more effectively because particles are closer together;	allow alternatives for vibrations e.g. oscillations allow "sound vibrates particles" allow equivalents for effectively e.g. faster, easily, efficiently etc.	2

(c)	(i)	(wave) speed = frequency × wavelength;	allow correct use of symbols and rearrangements e.g. $v = f \times \lambda$ condone s as symbol for speed	1
	(ii)	substitution OR rearrangement; evaluation; e.g. $340 = 1400 \times \lambda$ OR $\lambda = v / f$ (λ =) 0.24 (m)	 allow 0.243, 0.242857... etc. condone 0.242	2
	(iii)	any five from: MP1. sound heard by student A is louder; MP2. sound heard by student A is constant pitch; MP3. no change in sound heard by student A when speed of rotation is varied; MP4. sound heard by student B varies in pitch; MP5. sound heard by student B is high pitch when buzzer is **moving** towards them AND low pitch when **moving** away from them; MP6. change of pitch for student B is greater when speed of rotation is greater; MP7. sound varies in loudness for student B;	allow use of frequency instead of pitch throughout allow RA allow RA i.e. constant loudness for student A	5

Total for Question 2 = 13 marks

Question number	Answer	Notes	Marks
3 (a) (i)	C – the rod gains negatively charged electrons; A is incorrect because electrons are not positively charged B is incorrect because electrons are not positively charged D is incorrect because this would make the rod positively charged		1
(ii)	a named demonstration; a relevant observation; e.g. put charged rod near hair hair moves towards / is attracted to rod put charged rod near (small) pieces of paper pieces of paper move towards to the rod put charged rod near stream of water water bends towards the rod put rod next to another charged rod rod will move towards / away from other rod use a gold leaf electroscope (GLE) gold leaf deflects		2
(b)	MP1. method to allow (rods) to swing freely; MP2. idea that rods are brought close together; MP3. observation of attraction AND repulsion;	marking points may be shown on a labelled diagram e.g. suspend / balance on watch glass allow if another **charged** insulator used e.g. a balloon allow if rod brought near another **charged** insulator reject if method would not give attraction and repulsion e.g. holding rod near stream of water	3

Total for Question 3 = 6 marks

Question number	Answer	Notes	Marks
4	a description including any six from: MP1. nebula collapses / forms protostar; MP2. **temperature / brightness** of nebula / protostar increases; MP3. (when temperature becomes hot enough) fusion starts and star becomes main sequence; MP4. **brightness / temperature** of main sequence star depends on its mass; MP5. (when hydrogen runs out) main sequence star becomes red giant; MP6. red giants are **brighter** (than main sequence); MP7. red giants (surfaces) are **cooler** (than most main sequence stars); MP8. red giant becomes white dwarf; MP9. white dwarfs are **less bright** (than red giant / main sequence stars); MP10. white dwarfs are **hotter** (than red giant / most main sequence stars);	allow 'contracts' allow 'size' for mass	6

Total for Question 4 = 6 marks

Question number	Answer	Notes	Marks
5 (a) (i)	290 (s);		1
(ii)	substitution into P = E/t; evaluation; a matching unit for power; e.g. (P =) 39000/290 (P =) 130 watts / W	allow ecf from (a)(i) a correct unit for power may score 1 if no other mark scored allow 134.48... allow J/s answers of 0.13 kW, 0.13 kJ/s gain 3 marks answers of 0.13 W, 0.13 J/s gain 2 marks	3
(b)	correct evaluation of temperature change; substitution into $\Delta Q = m \times c \times \Delta\theta$; rearrangement; evaluation; e.g. temperature change = 49 (°C) $39\,000 = 0.45 \times c \times 49$ $(c =) 39\,000 / (0.45 \times 49)$ (c =) 1800 (J/kg°C)	allow 49 seen anywhere in working allow ecf from incorrect temperature change value of 50, 69 or 70 only -1 for POT error allow 1770, 1769, 1768.7... answer of 1.7687... gains 3 marks answer of 1733, 1256, 1238 gains 3 marks answer of 1.256..., 1.733..., 1.238... gains 2 marks	4

Total for Question 5 = 8 marks

Question number	Answer	Notes	Marks
6 (a)	step-down (transformer);		1
(b) (i)	idea of taking repeats (and removing anomalies);	allow repeating the investigation or individual readings	1
(ii)	only **two** columns or rows with headings of 'number of turns' and '(output) voltage';	columns can be in either order allow use of standard symbols e.g. n/N for number of turns and V for voltage	3
	correct units included only in voltage heading;	allow volts or V reject if units given with data values ignore any units given for number of turns	
	all data correctly included in body of table to same precision as given in the paper;		
(iii)	idea of increasing sensitivity of voltmeter e.g. 'using a voltmeter that measures to more decimal places';		1
(c) (i)	500 turns reading circled;		1
(ii)	straight line passing through all points except reading at 500 turns;	allow straight line with points evenly distributed either side	1
(iii)	simple pattern statement e.g. 'as the number of turns increases, the output voltage increases'; further detail e.g. linear relationship;	allow "they are proportional" for both marks only if line passes through origin	2

<table>
<tr>
<td>(d)</td>
<td>pair of readings correctly read from the graph / results table;
substitution into correct transformer formula;
rearrangement;

evaluation;

e.g.
number of turns = 600, output voltage = 7.5 V
V_1 / 7.5 = 1200 / 600
(V_1 =) (1200 × 7.5) / 600
(V_1 =) 15 (V)</td>
<td>

allow if seen anywhere in calculation either in symbols or numbers

<table><tr><th>N</th><th>V in V</th></tr><tr><td>100</td><td>1.3</td></tr><tr><td>200</td><td>2.5</td></tr><tr><td>300</td><td>3.8</td></tr><tr><td>400</td><td>5.0</td></tr><tr><td>500</td><td>6.3</td></tr><tr><td>600</td><td>7.5</td></tr></table>
allow range of 15–16 (V)</td>
<td>4</td>
</tr>
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Total for Question 6 = 14 marks

Question number	Answer	Notes	Marks
7 (a) (i)	momentum = mass × velocity;	allow rearrangements and standard symbols e.g. m = p / v reject m for momentum	1
(ii)	substitution; evaluation; e.g. (p =) 0.170 × 5.2 (p =) 0.88 (kgm/s)	-1 if POT error allow 0.884 (kgm/s)	2
(b) (i)	momentum of black ball calculated; conservation of momentum used correctly; final momentum of white ball calculated; evaluation of final velocity of white ball; e.g. p_{black} = 0.80 (kgm/s) 0.88 = p_{white} + 0.80 p_{white} = 0.08 (kgm/s) v_{white} = 0.47 (m/s)	ignore units stated or implied from calculation allow ecf from (a) ignore units allow 800 (gm/s) allow 80 (gm/s) allow 0.5, 0.4705… 0.49 for use of 0.884 from a(ii)	4
(ii)	80 (N); (to the) left;		2

Total for Question 7 = 9 marks

Question number	Answer	Notes	Marks
8 (a) (i)	work (done) = force × distance (moved in direction of force);	accept correct symbols and rearrangements e.g. W = F × s allow d for distance	1
(ii)	substitution; evaluation; e.g. (W =) 4.2 × 0.145 (W =) 0.61 (J)	-1 for POT error allow 0.609 (J) 609 (J) gains 1 mark	2
(iii)	same answer as (ii);		1
(iv)	kinetic energy (store) of molecules increases; (temperature increases) because temperature is proportional to (mean) KE (of molecules);	allow molecules move faster / eq	2
(b)	any one from: MP1. idea that (more) energy would be transferred / lost to the surroundings (for slow compressions); MP2. **piston** would have less KE (to transfer); MP3. less force on **piston** (so less work done on gas);	allow less work done on air	1

Total for Question 8 = 7 marks

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