Mark Scheme (Results)

November 2023

Pearson Edexcel International GCSE
In Physics (4PH1) Paper 2P

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>1 (a)</td><td>all five rows correct = 3 marks
3-4 rows correct = 2 marks
1-2 rows correct = 1 mark

<table><tr><th>Statement</th><th>Nuclear fusion</th><th>Nuclear fission</th></tr><tr><td>happens in the cores of stars</td><td>✓</td><td></td></tr><tr><td>happens when a nucleus absorbs a neutron</td><td></td><td>✓</td></tr><tr><td>causes large nucleus to split</td><td></td><td>✓</td></tr><tr><td>produces radioactive daughter nuclei</td><td></td><td>✓</td></tr><tr><td>uses hydrogen to produce helium</td><td>✓</td><td></td></tr></table></td><td>row cannot score if both boxes ticked

allow any reasonable indication other than a tick</td><td>3</td></tr>
<tr><td>(b)</td><td>high temperature;

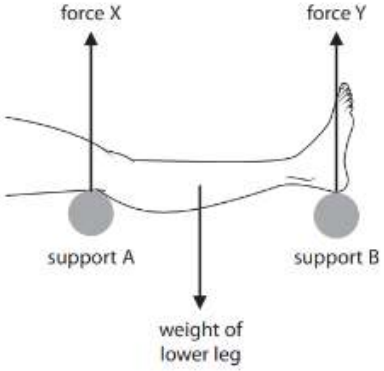
(so that) nuclei will have high(er) speed or high(er) {kinetic energy/KE};

high pressure;

plus one from:
• (so that nuclei will be) closer together / eq;
• (so that nuclei are) more likely to collide/ eq;</td><td>ignore references to repulsion or attraction
condone particles, atoms, molecules for nuclei

e.g. closely packed
e.g. collide more frequently</td><td>4</td></tr>
</table>

Total for Question 1 = 7 marks

Question number	Answer	Notes	Marks
2 (a) (i)	substitution OR rearrangement; evaluation; e.g. 19 = force × 0.55 OR force = moment/distance (force =) 35 (N)	 allow 34.5, 34.54, etc. -1 POT error	2
(ii)	A (0.25 m); B is incorrect because this is not a perpendicular distance C is incorrect because this is the distance between weight and force F D is incorrect because this is the distance to force F		1
(b) (i)	**force** X has the shorter distance to the CoG; moments of two forces must be equal/eq; so force X must be larger;  	Note: no credit for repeating question I.e. CoG is closer to support A condone reference to **force** A accept 'weight' for CoG allow RA i.e. (total) clockwise moment = (total) anti-clockwise moment DOP on either	3
(ii)	any three from: force X decreases; force Y increases; change by the same amount; total force remains the same;	 allow idea of change with distance is linear	3

Total for Question 2 = 9 marks

Question number	Answer	Notes	Marks
3 (a)	any five from: MP1. idea of mass of water = [mass of water and cup] − [mass of cup]; MP2. mass found on balance; MP3. time measured on timer/stopwatch/stopclock; MP4. idea of finding temperature change; MP5. energy supplied = voltmeter reading × ammeter reading × time; MP6. **whole experiment** repeated and averaged; MP7. water stirred (throughout); MP8. keep taking temperature after heater switched off for max temp; MP9. plot a graph of temperature against time; MP10. find gradient of temperature-time graph; and one from: MP11. use of equation "gradient = power of heater / m × c" or re-arrangement; MP12. rearrangement of formula sheet equation; i.e. c = energy supplied/(m × temp change)	 accept zeroing balance with cup present condone 'weighing scales' or 'scales' reject 'scale' allow 'measure volume of water with a measuring cylinder and multiply volume by density to find mass' for MP1 and MP2 accept idea of a fixed amount of time e.g. temp change = final temp − initial temp accept idea of a defined temperature change I.e. stop heating after a temp change of 20 degrees accept E = VIt accept use of joulemeter i.e. get several values of c	6

(b)	(i)	substitution into given formula; rearrangement; evaluation; e.g. 54 000 = 0.56 × c × 22 c = 54 000 / 0.56 × 22 (c =) 4400 (J/kg °C)	 -1 POT error allow 4383… allow any reasonable rounding ignore rounding error after 3sf	3
	(ii)	any two from: MP1. heating of beaker/heating of thermometer; MP2. heating of surroundings/heating of insulation; MP3. insulation not perfect; MP4. hole(s) in lid for thermometer/heater leave gaps;	ignore references to KE or sound allow idea of 'heat goes to beaker/thermometer' allow idea of 'heat going to surroundings or insulaton' e.g. insulation conducts or radiates allow idea of heat 'escaping' through lid or via evaporation	2

Total for Question 3 = 11 marks

Question number	Answer	Notes	Marks
4 (a)	substitution into given formula; rearrangement; evaluation; e.g. 16 = energy / 2.5 (× 3600) energy = 16 × 2.5 (× 3600) (energy =) 140 000 (J)	ignore units 2 marks max. if time not converted correctly to seconds e.g. 40 (J), 2400 (J) allow 144 000 (J) 2.5 × 60 × 60 or 9000 seen for 1 mark if no other mark awarded	3
(b)	any six from: MP1. it steps up or steps down the **voltage;** MP2. current in (primary) coil **produces** magnetic field; MP3. current is changing/alternating; MP4. causing a (changing) magnetic field **in the core**; MP5. the core strengthens the magnetic field; MP6. idea that iron is a soft magnetic material I.e. can gain and lose its magnetism easily MP7. field lines interact with (secondary) coil; MP8. which **induces** a voltage in the secondary coil; MP9. transformer won't work with (steady) d.c.;	 allow "increases", "decreases" or "changes" e.g. making the core magnetised allow "concentrates" for "strengthens" idea of core linking the two coils with magnetic field condone "induces a current" ignore idea of "works with a.c." repetition of stem	6
(c)	less turns (on the primary coil) / eq;	ignore any reference to secondary ignore references to increasing current, power or voltage of the primary coil condone 'coils' for 'turns'	1

Total for Question 4 = 10 marks

Question number	Answer	Notes	Marks
5 (a)	423 (K);	allow 423.15 (K), 423.16(K)	1
(b) (i)	B and D only;	both required	1
(ii)	particles closer together in solid;	accept RA ignore motion references may be shown in a clear, titled diagram	2
	particles have fixed or regular arrangement in solid but irregular in gas;	may be shown in a clear, titled diagram	
(iii)	kinetic energy stays constant / eq; and any two from: • temperature stays constant (during state change); • (average) speed of particles does not change; • (kelvin) temperature is (directly) proportional to (average) kinetic energy of particles;		3

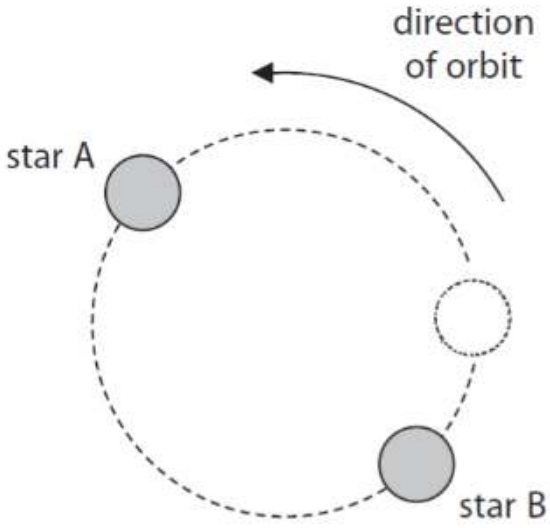
Total for Question 5 = 7 marks

Question number	Answer	Notes	Marks
6 (a)	idea that (total) momentum before = (total) momentum after (event);	ignore 'momentum is conserved'	1
(b) (i)	zero/0/nought/nothing;		1
(ii)	recall of momentum = mass × velocity; substitution; evaluation; e.g. p = mv p = $2.6 \times 10^{-8} \times 26\,000$ p = 6.8×10^{-4} (kg m/s)	allow standard symbols e.g. p = m × v -1 POT error allow 6.76×10^{-4}	3
(iii)	6.8×10^{-4} (kg m/s); right;	allow ecf from (ii)	2
(iv)	substitution into 'F=ma'; rearrangement; evaluation; answer given to 2s.f.; e.g. 2.6 ($\times 10^{-3}$)= 1.2 × acceleration acceleration 2.6 ($\times 10^{-3}$) / 1.2 (acceleration =) 2.16… × 10^{-3} (m/s^2) (acceleration =) 2.2 × 10^{-3} (m/s^2)	ignore units −1 for POT error independent mark	4
(c)	any two from: MP1. idea of tiny amount of fuel 'consumed' per second; MP2. any attempt of calculation of time to run out of xenon **seen**; MP3. correct calculation of 7.575... × 10^6 s; MP4. idea that 'burn' is for a long time; MP5. idea that low acceleration for long time gives high speed change; MP6. mass of spacecraft will be larger so acceleration is even smaller;	ignore idea of simple yes/no accept 88 or 87.68.. days, 2104 hours, 1.26.. × 10^5 minutes , 12.5.. weeks, 0.24... years	2

Total for Question 6 = 13 marks

Question number	Answer	Notes	Marks
7 (a)	microphone;		1
(b) (i)	determination of number of squares for one period; use of timebase to determine appropriate period in seconds; e.g. period = 8/1.5 = 5.3 squares period = (5.3 × 0.002 =) 0.011(s)	allow 5.2 – 5.5 squares '5 x 0.002' or '0.01' scores 1 '8 x 0.002' or '0.016' scores 1 accept 0.0104 – 0.0110 (s) for 2 marks	2
(ii)	use of f = 1 / T to evaluate frequency; e.g. frequency = (1 / 0.011 =) 91 (Hz)	allow ecf from (i) allow 90.9-96.2 (Hz)	1
(c) (i)	energy (transferred) = charge × voltage;	allow rearrangements and standard symbols e.g E = Q × V allow W for energy ignore C for charge	1
(ii)	amplitude of signal in volts determined; evaluation of effective voltage; evaluation of energy transferred; e.g. amplitude = 2 squares × 5 = 10 V effective voltage = 10 / √2 = 7.1 V energy transferred = (7.1 × 6.3×10^{-5} =) 4.5×10^{-4} (J)	ecf amplitude in volts reject 6.3×10^{-5} / √2 -1 POT error allow 4.4×10^{-4} – 4.5×10^{-4} (J) 8.9... $\times 10^{-4}$ scores 2	3

Total for Question 7 = 8 marks

Question number	Answer	Notes	Marks
8 (a)	X at 3 o'clock position on orbit by eye;  	any indicative mark within a star's radius of the correct position	1
(b)	difference in wavelength: 11 (nm); all substitutions correct in formula; rearrangement; evaluation; e.g. $\Delta\lambda = 561 - 550 = 11$ (nm) $11/550 = v / 3.0 \times 10^8$ $v = 11/550 \times 3.0 \times 10^8$ $(v =)\ 6.0 \times 10^6$ (m/s)	allow ecf from clear incorrect change in wavelength -1 POT error 5.88×10^6 scores 3 marks (wrong lab wavelength) ignore references to direction	4

Total for Question 8 = 5 marks