Mark Scheme (Results)

Summer 2023

Pearson Edexcel International GCSE

In Physics (4PH1) Paper 2P

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

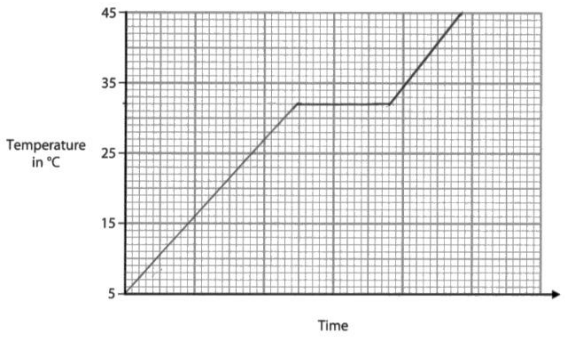
Summer 2023
Question Paper Log Number P71957A
Publications Code 4PH1_2P_2306_MS

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)	B – 16 g; A cannot be correct as g on Earth is not 100 C cannot be correct as g on Earth is not 1 D cannot be correct as g on Earth is not 0.1		1
(b) (i)	substitution into given formula; correct evaluation; correct answer: 0.59(2) (N cm) e.g. moment = 0.16 × 3.7 moment = 0.592 (N cm)	ignore units here accept 0.00592 Nm (i.e. unit on answer line changed) condone 1sf answer accept 0.00592 Nm (i.e. unit on answer line changed) -1 POT error otherwise	2
(ii)	0.59(2) (N cm);	ECF candidate's answer from (i)	1
(iii)	substitution; re-arrangement and evaluation; e.g. 0.592 = F × 7.4 F = 0.592 ÷ 7.4 = 0.08(0)	ECF candidate's answer from (ii) for substitution only ignore reverse argument accept 0.16 x 3.7 for 0.59(2) 0.592/7.4 = 0.080 or 0.59 /7.4 = 0.0797… or 0.6 /7.4 = 0.08108… all score 2 marks	2

Total for question 1: 6 marks

Question number	Answer	Notes	Marks
2 (a)	arrangement: fixed (position) / eq; motion: vibrating /eq ;	condone ideas of "regular" or "uniform"	2
(b) (i)	(movement now) random; idea that particles are no longer in fixed position;	ignore references to bonds, spacing or arrangement allow flowing past each other, reference to non-zero speed, non-zero KE condone 'free to move'	2
(ii)	D - thermometer; A cannot be the answer as a balance measures mass B cannot be the answer as a ruler measures length C cannot be the answer as a stopwatch measures time		1
(iii)	temperature increases from 5 °C to 45 °C; temperature remains constant at some stage below 45 degrees; single constant temperature section at 32 °C;  	ignore first constant section at 5 degrees ignore second constant section at 45 degrees	3

Total for question 2: 8 marks

Question number	Answer	Notes	Marks
3 (a) (i)	idea of transfer of electrons (from grid); grid has lost electrons;	reject reference to positive electrons this statement alone scores 2 reject "lost from electron supply"	2
(ii)	KE = ½ m v^2	accept word equation accept velocity for speed allow either case letters	1
(iii)	substitution in correct formula; re-arrangement; correct evaluation; correct answer: 5.3×10^7 (m/s) e.g. $1.3 \times 10^{-15} = ½ \times 9.1 \times 10^{-31} \times v^2$ $v^2 = 2.857\ldots \times 10^{15}$ $v = 5.345\ldots \times 10^7$ (m/s)	unrounded answer is 53452248 (m/s) allow full credit for correct answer with no working POT in final answer e.g. $5.345\ldots \times 10^3$ for 2 marks POT in v^2 giving 1.69… x 10^n (m/s) for v for 2 marks accept unrooted answer without POT error i.e. $2.857\ldots \times 10^{15}$ (m/s) for 2 marks accept POT and unrooted answer e.g. 2.86 x 10^n (m/s) for 1 mark max accept answer in any form except fractional	3
(b)	idea that electrons are (all) negatively charged/like charged; like charges **repel**;	reject idea of positive electrons for this MP only condone 'similar charge' accept idea of like charges experiencing a repulsive force	2

(c)	(i)	2.5 (cm);	allow 2.4 - 2.6 (cm)	1
	(ii)	substitution into given formula; conversion of ms to s and cm to m; correct evaluation using radius; correct answer: 6.5 (m/s) e.g. orbital speed = 2 π r ÷ T orbital speed = 2 π 2.5 x 10^{-2} ÷ (24 × 10^{-3}) orbital speed = 6.544… m/s	ECF candidate's answer to (c)(i) ignore POT at this point allow 654 cm/s (i.e. cm for m on answer line) allow full credit for correct answer with no working allow answers that round to the range 6.3 to 6.8 (m/s) -1 for POT conversion of milliseconds to minutes scores 2 (393 m/s)	3

Total for question 3: 12 marks

Question number	Answer	Notes	Marks
4 (a)	0.41 × 13; 5.3(3);		2
(b)	5.15 / 5.45 / 5.48 / 5.5;	allow ecf from (a)	1
(c)	same as candidate's answer to (b) i.e. 5.48 (kg m/s);		1
(d)	total mass = 0.58 (kg); substitution of candidate's answer to part (c); rearrangement and correct evaluation; correct answer: 9.4 (m/s) e.g. total momentum = 5.48 kg m/s total mass = 0.58 kg velocity = 5.48 ÷ 0.58 velocity = 9.448… (m/s)	accept re-calculation of total momentum 'from first principles' acceptable values for the velocity here are 8.88…,9.40… , 9.448…, 9.48… or ecf from (c) allow full credit for correct answer with no working	3

Total for question 4: 7 marks

Question number	Answer	Notes	Marks
5 (a)	(uranium) initial **nucleus** absorbs a neutron /eq ;	ignore collide/hit/aimed at reject atoms/molecules/particles etc	3
	(uranium) **nucleus** splits/fission releasing (further) neutron(s);		
	idea of neutrons can be absorbed by or can cause further fissions with **other** (uranium) nuclei		
(b)	any TWO from: absorb neutron(s);	ignore named material e.g. boron	2
	idea of preventing them from causing fission;		
	idea of slowing rate of fission;	condone reduces rate of reaction condone control rate of fission/rate of reaction	
(c)	fission is the **splitting** of a **nucleus**;	allow reasonable alternative for split	2
	fusion is the **combining** of **nuclei**;	allow reasonable alternative for combining, including 'fusing' reject atoms/particles/molecules/neutrons	
(d) (i)	C – fusion; A cannot be correct as there are very few nuclei with Z > 82; B cannot be correct as there are very few nuclei with A > 56; D cannot be correct as fusion is required to produce excited nuclei		1
(ii)	idea of (electrostatic) repulsion of nuclei or protons (prevents fusion);		1

Total for question 5: 9 marks

Question number	Answer	Notes	Marks
6 (a) (i)	(stepping up voltage) reduces current; reducing current reduces heating in the wire;	 allow idea of less energy loss or less power loss ignore unqualified reference to efficiency	2
(ii)	$(N_p \div N_s) = (V_p \div V_s)$	input (primary) voltage ÷ output (secondary) voltage = primary turns ÷ secondary turns; allow any correct rearrangement allow T or n for turns condone 'coils' for 'turns' reject phrase 'turns ratio'	1
(iii)	substitution; re-arrangement; correct evaluation; correct answer: 32 000 $(N_p \div N_s) = (V_p \div V_s)$ $(1400 \div N_s) = (15 \div 340)$ $N_s = (340 \div 15) \times 1400$ $N_s = 31\,733$	 -1 for PoT allow full credit for correct answer with no working rounding at different stages gives correct answers in range 31700 - 35000 worth full marks	3
(b)	 constant current gives constant magnetic field; induction (in transformers) requires a changing magnetic field; no voltage will be induced;	ignore references to a.c. allow 'flux' or 'field lines' for 'magnetic field' allow idea about requiring field line cutting for induction condone current for voltage	3

Total for question 6: 9 marks

Question number	Answer	Notes	Marks
7 (a) (i)	protractor;		1
(ii)	angle of incidence between 42 and 46 degrees; angle of refraction between 26 and 30 degrees;		2
(iii)	refractive index = sin(angle of incidence) ÷ sin(angle of refraction)	allow standard symbols i.e. n or eta for ref. index i , r etc	1
(iv)	substitution; correct evaluation; correct answer: 1.5 e.g. n = sin(i) ÷ sin(r) n = sin() ÷ sin() = 1.479…	Allow ecf from (ii) allow full credit for correct answer with no working reject division of i and r giving approx 1.5-1.6 range of values with 'in tolerance' values for i and r is 1.34-1.64	2
(b) (i)	15 (nm);		1
(ii)	substitution into given formula; re-arrangement; correct evaluation; correct answer: 7 100 000 (m/s) e.g. $\Delta\lambda \div \lambda = v/c$ $15 \div 630 = v \div (3.0 \times 10^8)$ $v = (3.0 \times 10^8) \times (15 \div 630)$ $v = 7.14 \times 10^6$ (m/s)	ecf from (i) allow in either order allow full credit for correct answer with no working -1 POT error use of observed wavelength instead of 630 nm i.e. 645 nm giving 6.976… x10^6 (m/s) gives 1 mark max	3

(iii)	link between twice the redshift and twice the speed; PLUS one from: link between larger speed and larger distance; (which in turn means that) galaxies are moving **apart** /moving away **from each other**;	ignore references to single point/singularity, universe expansion, Big Bang itself accept redshift and speed are directly proportional condone link between larger redshift and larger speed accept quotation of Hubble's Law condone stars for galaxies reject planets etc for galaxies	2

Total for question 7: 12 marks

Question number	Answer	Notes	Marks
8 (a)	Any FIVE from: MP1 mass found on balance; MP2 time measured on timer/stopwatch/stopclock; MP3 temperature change = final temp – initial temp; MP4 energy supplied = voltmeter reading × ammeter reading × time; MP5 **rearrangement** of formula sheet equation; i.e. c = energy supplied/(m × temp change) MP6 keep taking temperature after heater switched off for max temp; MP7 plot a graph of temperature against time; MP8 find gradient of temperature-time graph; MP9 use of "equation gradient = power of heater / m x c" or re-arrangement; MP10 (whole experiment) repeated **and** averaged;	condone scales reject scale allow idea of a known mass e.g. 1 kg allow idea of a specified time e.g. 10 minutes allow idea of a specified temp change e.g. 10 degrees accept idea of measuring temperature change accept energy = power x time accept use of joulemeter	5
(b)	concrete can store/absorb/release a lot of energy (because of high SHC); water temp maintained for longer/ temp rise for water more than temp drop for concrete;	allow idea of large energy store per unit mass allow idea of being able to provide heating to the water for a long time	2

Total for question 8: 7 marks

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom