Mark Scheme (Results)

January 2021

Pearson Edexcel International GCSE
In Physics (4PH1) Paper 1P and Science (Double Award) (4SD0) Paper 1P

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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	kinetic; main sequence; contract; expand; supernova; neutron star;		6

Total for Question 1 = 6 marks

Question number	Answer	Notes	Marks
2 (a) (i)	(average) speed = distance (moved) / time (taken);	allow standard symbols and rearrangements e.g. v = s / t allow s for speed, d for distance	1
(ii)	substitution; evaluation; e.g. (speed =) 6.5 / 0.25 (speed =) 26 (m/s)		2
(iii)	correct conversion of EITHER m to km OR s to h; full conversion from m/s to km/h AND consistent conclusion;; e.g. 26 (m/s) = 0.026 (km/s) OR 26 (m/s) = 93600 (m/h) 94 (km/h) => too fast	allow ECF from (ii) allow ECF from (ii) allow conversion of km/h to m/s e.g. 80km/h = 22.2m/s allow 93.6 (km/h)	2
(b) (i)	acceleration is the gradient (of the graph); graph has a constant gradient;	 allow line on graph is straight	2
(ii)	acceleration = change in velocity / time;	allow standard symbols and rearrangements e.g. a = (v-u) / t, a = Δv / t	1
(iii)	correct reading of either two velocity values or time interval taken from graph; correct substitution into formula; evaluation; e.g. u = 5 (m/s), v = 24 (m/s) OR t = 60 (s) (a =) 24-5 / 60 (a =) 0.32 (m/s^2)	allow attempt at gradient calculation allow (v – u =) 19 seen allow range of 0.30-0.32	3

Total for Question 2 = 11 marks

Question number	Answer	Notes	Marks
3 (a)	idea that if one bulb fails all bulbs turn off;	allow idea that bulbs cannot be controlled individually	1
(b)	any one from: • less likely to overheat; • idea that the circuit is simpler; • lower voltage bulbs; • all bulbs controlled with one switch;	accept uses fewer wires	1
(c) (i)	voltage = current × resistance;	allow standard symbols and rearrangements e.g. I = V / R	1
(ii)	substitution; rearrangement; evaluation; e.g. 33 = I × 390 (I =) 33 / 390 (I =) 0.085 (A)	 allow 0.08, 0.0846... condone 0.084	3
(iii)	dimensionally correct substitution into E = V × I × t; conversion of hours to seconds; use of 7 bulbs; evaluation; e.g. E = 33 × 0.085 × 2.5 2.5 hours = 9000 seconds voltage used = 231 OR ×7 used in working (E =) 180 000 (J)	allow ECF from (ii) allow 60 × 60 or 9000 seen anywhere in working 23 760-25 245 = 3 marks (x7 not used) 6.60-7.01 = 2 marks allow answer between 165000 to 180000	4
(d)	brightness is greater in lamp Y; with any **two** from: more energy transferred to each bulb in lamp Y; bulbs in lamp Y have a larger voltage / 46 V; resistance of (circuit in) lamp Y is less; current in bulb / circuit in lamp Y is greater;	allow RA	3

Total for Question 3 = 13 marks

Question number	Answer	Notes	Marks
4 (a)	live / L;	allow red / brown wire	1
(b)	any two from: MP1. earth wire; MP2. circuit breaker; MP3. double insulation; MP4. insulated cables;	 allow RCD, trip switch, surge protector allow any mention of insulated wires	2
(c) (i)	power = current × voltage;	allow standard symbols e.g. P = I × V ignore C, c for current	1
(ii)	substitution; evaluation; unit; e.g. (P =) 9.6 × 230 (P =) 2200 watts / W	 mark independently 2.2 kW = full marks allow 2208, 2210 allow J/s	3
(iii)	 coil has resistance; electrons transfer/lose energy (as they flow through coil); (due to) electron collisions with (lattice) ions in the coil;	allow wire for coil throughout allow atoms, particles for ions	3
(d)	idea of excessive current; melts the fuse (wire); breaking the **circuit**;	e.g. “current becomes too high” allow breaking the fuse condone “blows the fuse” allow “stops the current” / eq	3

Total for Question 4 = 13 marks

Question number	Answer	Notes	Marks
5 (a)	any one from: • handling source with tongs/gloves; • storing source in lead box (when not in use); • minimising time handling source; • maximising distance from source; • taking care with direction of emission from source; • use of lead apron/shielding;	ignore if mention of other room etc.	1
(b)	B (138); A is incorrect because this is the number of protons C is incorrect because this is the number of nucleons D is incorrect because this is the number of nucleons + protons		1
(c) (i)	photographic film / Geiger-Muller tube;	allow GM tube, GM detector condone Geiger counter allow spark counter	1
(ii)	alpha / α;		1
(d) (i)	time taken; and either of • for (radio)activity to halve; • for half of the (radioactive) nuclei / atoms / isotope to decay;	allow "how long it takes" reject "half the time" allow count rate for activity	2
(ii)	C (1.88×10^{21}); A is incorrect because this is the number of atoms after 3200 years B is incorrect because this is the number of atoms after 1600 years D is incorrect because this is the initial number of atoms		1

Total for Question 5 = 7 marks

Question number	Answer	Notes	Marks
6	**max. 2 marks for details of varying temperature** MP1. suitable method of heating ball; MP2. thermometer used to measure temperature; **max. 2 marks for control variables** MP3. height ball is dropped from; MP4. bouncing surface; MP5. ball dropped from rest each time; **max. 2 mark for high-quality data** MP6. suitable method to increase/give good accuracy of bounce height measurement; MP7. at least five different temperatures tested; MP8. repeats and average;	any mark can be given from labelled diagram e.g. water bath, oven, freezer, heating water in beaker allow temperature sensor and data logger ignore "same ball" allow idea of no force being used to drop ball e.g. viewing at eye level, recording with camera and viewing at slow motion can be inferred from method	6

Total for Question 6 = 6 marks

Question number	Answer	Notes	Marks
7 (a)	north pole labelled on magnet Y; lines drawn straight and vertical between magnets; lines are equally spaced with arrows pointing upwards;	ignore curved lines at the edges of the magnets	3
(b) (i)	any two from: MP1. iron is (a) magnetic (material); MP2. iron ball becomes a magnet / becomes magnetised (N pole at top); MP3. iron ball is attracted to the magnet;		2
(ii)	downward arrow drawn shorter than magnetic force arrow;	ignore starting point of arrow, judge length and direction only	1
(iii)	weight = mass × gravitational field strength;	allow standard symbols and rearrangements e.g. m = W / *g*	1
(iv)	calculation of weight; dimensionally correct substitution into weight formula; rearrangement; evaluation; e.g. weight = (165 – 124 =) 41 (mN) 0.041 = mass × 10 (mass =) 0.041 / 10 (mass =) 0.0041 (kg)	ECF if incorrect weight or 165, 124, 289 used as the weight allow g=9.8, 9.81 -1 for POT error provided 10 (N/kg) is used somewhere 0.0165, 0.0124, 4.1 gets 3 marks max 16.5, 12.4 gets 2 marks max	4
(v)	any two from: MP1. weight (of the iron ball) stays the same; MP2. magnetic force increases; MP3. magnetic field strength increases;	allow greater attraction from magnet	2

Total for Question 7 = 13 marks

Question number	Answer	Notes	Marks
8 (a)	any one from: • idea that there is no data at the value of 0; • idea that {pressure of gas / speed of particles} cannot be zero; • idea that all data would be bunched together at the top of the axis / eq;		1
(b)	for either graph: MP1. as temperature increases, pressure/speed increases; for graph 1: MP2. relationship is linear; for graph 2: MP3. relationship is non-linear; MP4. idea of decreasing gradient of curve;	ignore positive correlation accept proportional only if there is a clear link to the temperature being measured in kelvin	3
(c)	any two from: MP1. this temperature is <u>absolute zero</u>; MP2. pressure/speed/kinetic energy of gas particles would be 0 at this temperature; MP3. idea that it is impossible to have a temperature lower than this;	allow idea that negative pressure/speed/KE is impossible	2
(d) (i)	answer in range 520-525 (m/s);	ignore 515	1
(ii)	recall of KE formula; substitution; evaluation; e.g. KE = ½ × mass × speed^2 (KE =) 0.5 × 5.3 × 10^{-26} × 520^2 (KE =) 7.2 × 10^{-21} (J)	can be implied from working ECF from (i) -1 for POT error allow 7.16×10^{-21} - 7.31×10^{-21}	3
(iii)	373 (K);		1
(iv)	straight line with positive gradient; line passes through origin;	judge straightness by eye	2

Total for Question 8 = 13 marks

Question number	Answer	Notes	Marks
9 (a) (i)	correctly reflected ray of light drawn at A;	judge angle of reflection = angle of incidence by eye allow dotted lines, lines without arrowheads ignore lines inside the block	1
(ii)	i = 60 (°); r = 31 (°);	allow 59-61 inclusive allow 30-32 inclusive	2
(iii)	n = sin(i) / sin(r);	allow in words and rearrangements	1
(iv)	substitution; evaluation; e.g. (n =) sin(60) / sin(31) (n =) 1.68	allow ECF from (ii) allow 1.61-1.75	2
(v)	any three from: MP1. take repeat readings **at a specific angle**; MP2. vary angle of incidence; MP3. find mean values for one angle i / mean refractive index; MP4. plot graph of sin(i) against sin(r); MP5. find refractive index from gradient of graph;	ignore bald "repeat and average" ignore "repeat investigation"	3
(b)	ray drawn with smaller angle of refraction than red light when it enters block; ray bends away from the normal when it leaves the glass block; ray drawn parallel to red light as it leaves block;		3

Total for Question 9 = 12 marks

Question number	Answer	Notes	Marks
10 (a)	black because it is a better/good absorber; of radiation (from the Sun);	ignore references to emission allow IR, infrared for radiation	2
(b)	any four from: MP1. temperature of air increases; MP2. air expands / air particles move further apart; MP3. density of air decreases; MP4. warm/heated air rises; MP5. cool air replaces warmed air; MP6. process repeats;	 allow air particles gain KE reject particles expand reject particles become less dense ignore heat rises allow cool air sinks	4

Total for Question 10 = 6 marks

Question number	Answer	Notes	Marks
11 (a)	determination of mass of water; substitution into / rearrangement of density formula; evaluation; rounding to 3 s.f.; e.g. mass = 49.5 (g) 0.998 = 49.5/volume OR volume = mass/density volume = 49.599 49.6 (cm^3)	 allow ECF from incorrect mass mark independently	4
(b)	determination of mass of liquid; use of volume from (a); evaluation; e.g. 143.8 - 63.4 = 80.4 (g) density = 80.4 / 49.6 density = 1.62 (g/cm^3)	 allow ECF from (a) allow ECF from incorrect mass	3
(c)	any three from: MP1. with measuring cylinder can read volume to nearest cm^3; MP2. measuring cylinder is easier/quicker to use; MP3. measuring cylinder does not need to be dried; MP4. idea that measuring cylinder value could be incorrect due to parallax errors/meniscus etc; MP5. 'bottle' gives volume to nearest 1dp; MP6. 'bottle' allows density to be more precisely determined;	allow RA throughout	3

Total for Question 11 = 10 marks

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