Mark Scheme (Results)

Summer 2019

Pearson Edexcel International GCSE
in Physics (4PH1)
Paper 1P

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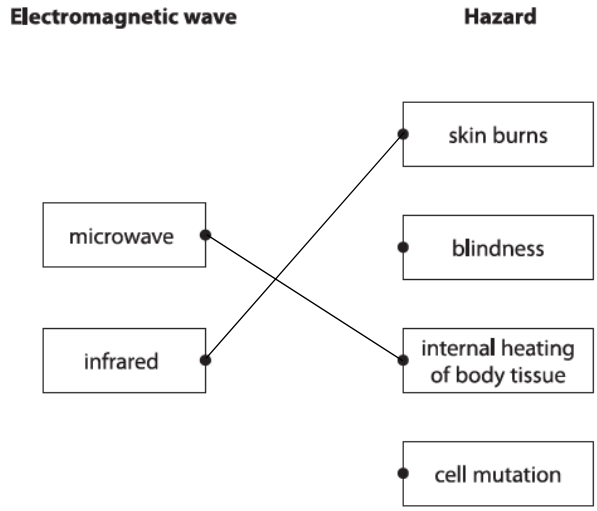
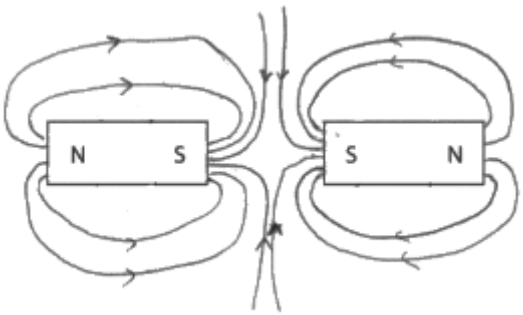
Summer 2019
Publications Code 4PH1_1P_msc_20190822

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)	C (sound waves); A is incorrect because it is a transverse wave B is incorrect because it is a transverse wave D is incorrect because it is a transverse wave		1
(ii)	one mark for each correct line;;  	two lines from any left hand box is a contradiction and scores zero for that box	2
(b) (i)	A (checking for broken bones); B is incorrect because microwaves and infrared have this use C is incorrect because ultraviolet has this use D is incorrect because alpha radiation has this use		1
(ii)	B (cooking food); A is incorrect because x-rays has this use C is incorrect because ultraviolet has this use D is incorrect because gamma has this use		1

Total for Question 1 = 5 marks

Question number	Answer	Notes	Marks
2 (a)	MP1. method to show shape; e.g. use compass(es) use of iron filings / powder MP2. use of plotting compass **to show direction**; MP3. a further method detail; e.g. move compass / multiple compasses in different positions idea of another line or lines added sprinkle iron filings (on to card) tap card (to distribute iron filings)	all marks may be given from diagram allow if compass seen in diagram pointing in a suitable direction allow equivalent materials to card e.g. paper, plastic etc.	3
(b)	correctly drawn field line patterns for both bar magnets; correctly drawn field line pattern for region between the magnets; at least three field line directions given from north to south;  	 should show no lines linking south poles not every line needs to have an arrow reject mark if directions contradict 2 marks max. if any lines overlap condone lines touching	3

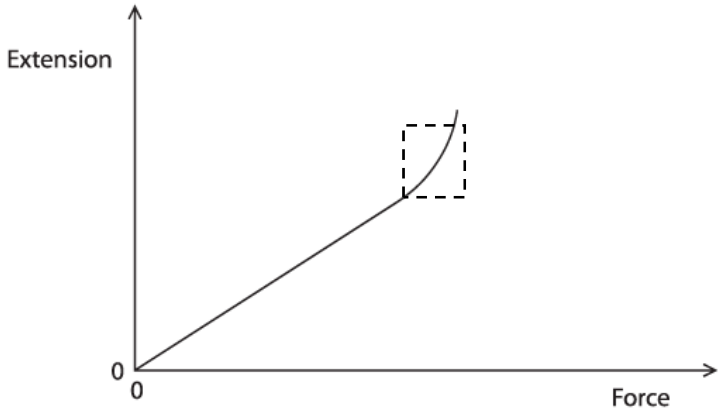
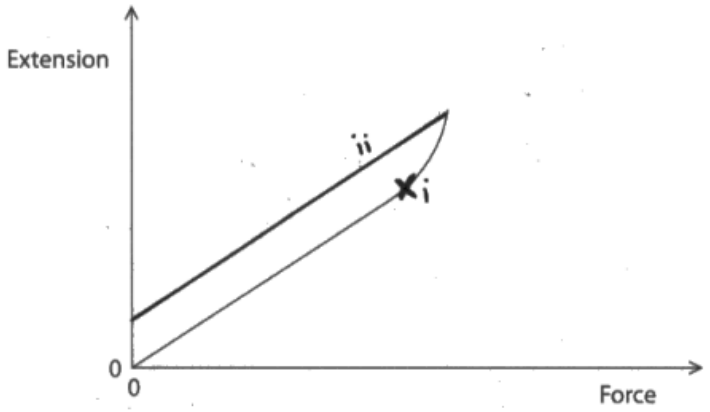
Total for Question 2 = 6 marks

Question number	Answer	Notes	Marks
3 (a)	gamma is more penetrating (than alpha); (therefore) idea that gamma can pass through the box / fruit;	ignore refences to ionising ability allow RA allow alpha has shorter range (in air) allow RA allow alpha won't reach the box	2
(b)	any two from: MP1. fruit has no bacteria / (all) bacteria on fruit have been killed; MP2. fruit has not been contaminated; MP3. fruit has not been made radioactive; MP4. radioactive source has not been in contact with the fruit;	 allow fruit does not contain any radioactive isotopes allow fruit does not emit radiation	2

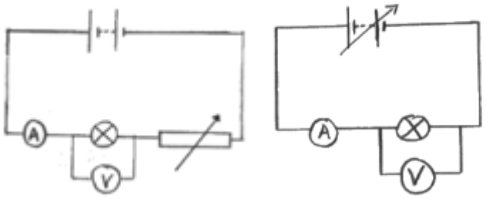
Total for Question 3 = 4 marks

Question number	Answer	Notes	Marks
4 (a) (i)	0.9 (s);		1
(ii)	distance = area (under line);	allow ECF from incorrect time found in (a)(i) can be implied from calculation, explicit statement or working on graph itself	4
	thinking distance (rectangle) = 13.5 (m) OR braking distance (triangle) = 23.25 (m) correctly determined;		
	attempt at calculating area of a trapezium / adding values for areas of rectangle and triangle;		
	(stopping distance =) 37 (m);	allow 36.75, 36.7, 36.8	
(iii)	acceleration formula seen in working;	can be implied from substitution of data	3
	correct substitution into acceleration formula; evaluation of acceleration;	allow ECF from incorrect time found in (a)(i) reject if given as a positive value	
	e.g. (acceleration =) change in velocity ÷ time	allow (a =) v-u ÷ t allow acceleration is gradient condone change in speed ÷ time	
	(acceleration =) (−)15 / 3.1 (acceleration =) −4.8 (m/s^2)	allow any answer that rounds to −4.8 allow deceleration = 4.8 (m/s^2)	
(b)	max. two factors linked to thinking distance: MP1. tiredness (of driver); MP2. age (of driver); MP3. alcohol or drug consumption; MP4. distraction (of driver);	allow 'reaction time' if no other thinking distance mark achieved ignore factors affecting visibility e.g. caffeine, medicine etc. e.g. using a mobile phone etc.	4
	max. two factors linked to braking distance: MP5. mass / weight of car; MP6. condition of brakes; MP7. condition of road; MP8. condition of tyres; MP9. slope of road;	ignore bald "the weather" allow however expressed e.g. more people, less luggage etc. e.g. icy road, wet road e.g. how much grip left / eq e.g. whether the car is going up or downhill	

Total for Question 4 = 12 marks

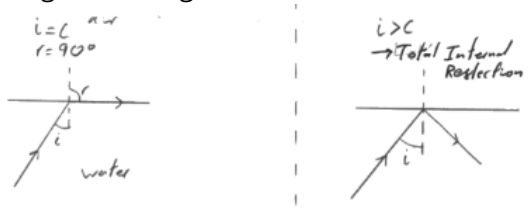
Question number	Answer	Notes	Marks
5 (a) (i)	cross drawn on line in region shown;  	cross cannot be drawn at the extreme upper end of the curved line	1
(ii)	any line drawn above and starting at the end of the original that shows a reduction in extension as the force is decreased; line drawn is straight and returns to the extension axis above the origin;  	DOP judge straightness by eye	2
(b) (i)	elastic (potential);		1
(ii)	C (mechanically); A is incorrect because there is no electrical circuit B is incorrect because there is no temperature difference D is incorrect because transfers by radiation do not involve forces		1

Total for Question 5 = 5 marks

Question number	Answer	Notes	Marks
6 (a) (i)	circuit with symbols for ammeter, voltmeter, lamp, any power supply all correct;	variable power supplies or variable number of cells can be shown using labelled standard symbols	4
	voltmeter in parallel with lamp; ammeter in series with lamp;	if no lamp in circuit, allow ammeter drawn in series with power supply	
	correct means of varying voltage of lamp i.e. variable power supply/rheostat/potentiometer;	allow variable resistor in series with lamp	
	e.g. 		
(ii)	any four from: MP1. record ammeter and voltmeter reading;	allow 'measure voltage and current'	4
	MP2. repeat readings (for each voltage) and find average;	allow repeating experiment to find average	
	MP3. idea of changing the voltage / current;	allow described method that would change voltage or current e.g. adding more cells, changing circuit resistance etc.	
	MP4. plot a graph of voltage and current; MP5. switch off current/circuit between readings;	ignore "let lamp cool between readings"	
(b) (i)	ampere / amp / A / mA;	reject I	1
(ii)	correctly evaluated energy; given to 2 significant figures; e.g. 162 (J) gets 1 mark 160 (J) gets 2 marks	DOP	2
(iii)	red or orange;		1

Total for Question 6 = 12 marks

Question number	Answer	Notes	Marks
7 (a)	waves change {speed / wavelength / direction} when they change medium;	allow waves bending allow any reasonable alternative to 'change medium' i.e. changing (optical) density, pass from one material to another etc.	1
(b) (i)	straight ray bent towards normal at the air-water boundary; correct angle of refraction by eye;	judge straightness of ray by eye	2
(ii)	refractive index = sin*i* / sin*r*;	allow rearrangements and standard symbols e.g. n = sin*i* / sin*r*	1
(iii)	substitution; evaluation to at least 3s.f.; e.g. (n =) sin45 / sin33 (n =) 1.30	reject 45/33 reject 1.36 reverse argument scores 1 mark only e.g. calculating *i* or *r* using n allow 1.298... condone 1.29	2

Question number		Answer	Notes	Marks
(c)	(i)	the angle of incidence (in the slower medium); above which gives total internal reflection OR gives an angle of refraction of 90°; 	allow ideas if clear from diagram allow TIR for total internal reflection	2
	(ii)	$\sin c = 1 / n$;	allow rearrangements and mixture of symbols and words	1
	(iii)	substitution; rearrangement; evaluation; e.g. $\sin c = 1/1.3$ $c = \sin^{-1}(1/1.3)$ (c =) 50 (°)	 allow 50.3, 50.28...	3
	(iv)	single straight ray reflected downwards from water surface; angle correct by eye;	any ray above water surface scores zero	2

Total for Question 7 = 14 marks

Question number	Answer	Notes	Marks
8 (a) (i)	downward force arrow labelled “weight”; upward force arrow labelled “drag” / “air resistance”; upward force larger than downward force by eye;	ignore starting position of arrows and any horizontal arrows allow “gravitational force”, “gravitational pull”, “force of gravity” reject “gravity” allow “friction” ignore “upthrust”	3
(ii)	any four from: MP1. air resistance increases (greatly) when parachute is opened; MP2. idea that air resistance is greater than weight; MP3. (therefore) resultant force is upwards; MP4. idea that as speed decreases, air resistance decreases; MP5. resultant force (eventually) becomes zero; MP6. constant speed achieved;	allow “drag” for air resistance throughout condone “gravity” for weight throughout allow “upwards force” for air resistance allow upward force is bigger than downward force allow deceleration / upwards acceleration ignore “it slows down” allow forces are balanced/equal air resistance = weight allow idea that there is no acceleration	4

(b)	attempted use of $v^2 = u^2 + (2 \times a \times s)$; correct substitution; rearrangement of formula / evaluation of v^2; evaluation of v; e.g. $v^2 = u^2 + (2 \times a \times s)$; $v^2 = 0.45^2 + (2 \times 3.4 \times 2.0)$; $v = \sqrt{(0.45^2 + (2 \times 3.4 \times 2.0))}$ OR $v^2 = 13.8$ (v =) 3.7 (m/s)	accept answers in terms of GPE lost = KE gained, whatever candidate chooses for mass can be implied from calculation reject if contradicted by another irrelevant formula and no further working seen allow if 13.8 seen allow 3.72, 3.715...	4
(c)	any one from: MP1. Mars has a smaller mass; MP2. Mars has a lower density; MP3. Mars has a smaller (iron rich) core;	allow RA allow Mars is less massive	1

Total for Question 8 = 12 marks

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>9 (a)</td><td>1 mark for each correct answer in the table;;;;;

<table><tr><th>Part</th><th>Function</th><th>Suitable material</th></tr><tr><td>control rod</td><td>absorbs neutrons / regulates number of neutrons / controls rate of reaction</td><td>boron</td></tr><tr><td>moderator</td><td>slows <u>neutrons</u> / absorbs KE of <u>neutrons</u></td><td>graphite</td></tr><tr><td>shielding</td><td>prevents irradiation of workers</td><td>concrete / lead / steel / water</td></tr><tr><td>fuel Rod</td><td>idea that it provides material for fission</td><td>uranium(-235/238) / plutonium / U / Pu</td></tr></table></td><td></td><td>5</td></tr>
<tr><td>(b) (i)</td><td>same number of protons;

different number of neutrons;</td><td>allow same atomic number, same element
allow different nucleon number, different mass number, different atomic mass</td><td>2</td></tr>
<tr><td>(ii)</td><td>fission is the splitting of a <u>nucleus</u>;

fusion is the joining of two <u>nuclei</u>;</td><td>allow “breaking down” for splitting
allow “fusing”, “combining” for joining</td><td>2</td></tr>
<tr><td>(iii)</td><td>star / <u>fusion</u> reactor / hydrogen bomb / red giant / supernova;</td><td>allow any named star or fusion reactor, i.e. Sun, JET, ITER
reject protostar, white dwarf</td><td>1</td></tr>
<tr><td>(iv)</td><td>any two from:

MP1. nuclei move (too) slowly at low temperature;

MP2. nuclei interact/collide less often at low pressure;
MP3. <u>nuclei</u> repel each other;
MP4. <u>nuclei</u> cannot get close enough / don’t have chance to undergo fusion;</td><td>allow RA in terms of high temperature and high pressure
allow nuclei not having enough KE
allow atoms/particles for nuclei
allow atoms/particles for nuclei</td><td>2</td></tr>
</table>

Total for Question 9 = 12 marks

Question number	Answer	Notes	Marks
10 (a)	use of voltage = current × resistance; calculation of voltage across 240 ohm resistor (2.88 V); idea that voltages of two resistors in series adds up to supply voltage; evaluation of voltage across R; e.g. $V = I \times R$ $V_{240} = (0.012 \times 240 =) 2.88$ (V) $V_R + V_{240} = 9.2$ (V_R =) 6.3 (V)	allow rearrangements and standard symbols calculate total resistance of circuit (767 Ω) evaluation of resistance of R (527 Ω) evaluation of voltage across R (using V = IR) allow 2.9 (V) allow 9.2 – 2.88 or V + 2.88 = 9.2 allow 6.32 (V) if mA not converted to A and 2880 seen then award 2 marks max.	4
(b) (i)	any three from: MP1. coil produces a magnetic field; MP2. (which) interacts with the magnetic field of the (permanent) magnet; MP3. producing a force acting on the coil; MP4. opposite forces on either side of coil; MP5. coil rotates / turns;	 allow coil becomes an electromagnet allow one side is pushed up and the other is pushed down allow coil spins, pointer moves (to the left)	3
(ii)	vertical arrow UP (on wire CD);		1
(iii)	any three from: MP1. more turns on the coil; MP2. stronger (permanent) magnet; MP3. add an iron core; MP4. producing a larger force (for the same current); MP5. use of a longer pointer; MP6. use of a weaker return spring; MP7. producing a greater movement at the end of the pointer (for the same current);	 allow “more coils” allow method to increase field strength e.g. moving magnets closer together allow producing the same force for a smaller current allow same movement for a smaller current	3

Total for Question 10 = 11 marks

Question number	Answer	Notes	Marks
11 (a)	conversion of cm to m; substitution into given formula; evaluation; e.g. 3.8cm = 0.038 pressure difference = $0.038 \times 1.3 \times 10^4 \times 10$ (pressure difference =) 4900 (Pa)	seen anywhere in working -1 for POT error 494 000 gains 2 marks allow 4940 (Pa) allow 4800, 4840, 4846, 4841 (Pa) for use of g=9.8/9.81	3
(b) (i)	any three from: MP1. particles have more energy in their kinetic store / particles speed up; MP2. {more **frequent** collisions / more collisions per second} with the walls of the tube; MP3. each collision with the wall is harder; MP4. increasing the force (on the walls of the container);	 allow particles have more KE allow particles collide more often with walls ignore collisions with each other allow 'greater momentum change'	3
(ii)	conversion of temperatures to kelvin; substitution; rearrangement; evaluation; e.g. $T_1 = 289K$, $T_2 = 305K$ $9.95 \times 10^4 / 289 = p_2 = 305$ $p_2 = 9.95 \times 10^4 \times 305 / 289$ (p_2 =) 1.1×10^5 (Pa)	not converting to kelvin giving 199 000 (Pa) gains 2 marks max. allow 1.05×10^5 (Pa), 105008.65... (Pa)	4

Total for Question 11 = 10 marks

Question number	Answer	Notes	Marks
12 (a)	substitution into GPE = mass × *g* × height; at least one quantity correctly converted to SI units; correct evaluation; e.g. GPE = 0.580 × 10 × 0.92 mass = 0.580 (kg) OR height = 0.92 (m) (GPE =) 5.3 (J)	allow substitution with no unit conversions allow *g* = 9.8, 9.81 allow 5.2, 5.34, 5.336, 5.23...	3
(b)	any four from: MP1. mention of energy being transferred <u>mechanically</u> at any stage in the response; MP2. (before it is dropped) dough initially has energy in its gravitational store (and no energy in its kinetic store); MP3. (just before it hits the floor) energy is in the dough's kinetic store (and less energy in its gravitational store); MP4. (as the dough falls / after the dough has hit the floor) the thermal store **of the air / floor / surroundings** has increased; MP5. (after the dough has hit the floor) the thermal/elastic store **of the dough** has increased (and the kinetic store of the dough is zero); MP6. energy has been transferred to the surroundings (mechanically and) by radiation;	 condone the ball initially having GPE condone energy transferred to KE condone energy transferred to heat energy of the surroundings ignore references to sound energy condone energy transferred to elastic/heat energy of the dough	4

Total for Question 12 = 7 marks