

Mark Scheme (Results)

January 2018

Pearson Edexcel International GCSE

In Physics (4PH0) Paper 1P



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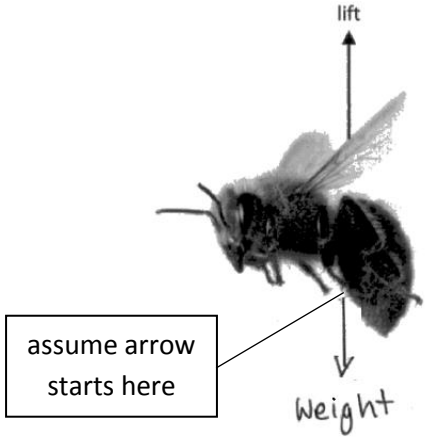
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General Marking Guidance

- 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		light; (to) electrical;	must be in this order only	2
b	(i)	charge = current x time;	allow rearrangements and standard symbols e.g. Q=Ixt reject use of c/C for current and charge	1
	(ii)	substitution; evaluation; e.g. (charge =) 2.3 x 15 (charge =) 35 (C)	 allow 34.5	2
c		idea that solar panels will still produce electricity if one breaks / does not receive light;	allow idea that they still work if one breaks / does not receive light ignore ideas relating to independent switching	1

Total for question 1 = 6 marks

Question number	Answer	Notes	Marks
2 a	downward arrow labelled 'weight' / 'air resistance'; downward arrow is shorter than lift arrow (by eye);  	ignore horizontal arrows allow gravitational force, force due to gravity, W, mg, AR ignore spelling ignore 'gravity' 'G' judge length of arrow starting from the bottom of the bee ignore horizontal position of arrow	2
b (i)	B;		1
(ii)	A;		1
(iii)	(average) speed = $\frac{\text{distance (moved)}}{\text{time (taken)}}$;	allow rearrangements and standard symbols e.g. v=s/t s=d/t	1
(iv)	substitution; evaluation; e.g. (speed =) 19.5/35 (speed =) 0.56 (m/s)	allow distances used in range 19.5-20.0 (m) allow answers in range 0.55 – 0.57 (m/s) answer of 0.54 (using speed=19) gains 1 mark only 0.5571429 allow 0.6 if supported by working	2

c	(i)	any one of: fluorescence; production of vitamin D; calcifying fillings/eq; killing bacteria; treating skin conditions/(skin) cancer;	ignore **unqualified** ultraviolet lamps, security markers etc. allow tanning bed, fluorescent tubes, **detecting** security markings/false bank notes allow setting fillings	1
	(ii)	any **one** similarity from: MP1. both EM waves / part of EM spectrum; MP2. both travel at the same speed / speed of light (in free space); MP3. both transverse waves; MP4. both can travel through a vacuum; any **one** difference from: MP5. visible light has **lower** frequency / ORA; MP6. visible light has **higher** wavelength / ORA;	 allow $3x10^8$ m/s ignore references to energy and penetrating power, ultraviolet can't be seen by humans	2

Total for question 2 = 10 marks

Question number	Answer	Notes	Marks
3	any three from: MP1. reaction time of driver (including comment on drink / drugs / driver paying attention / driver distracted / driver tired); MP2. condition of car's brakes / force applied to brakes; MP3. condition of car's tyres; MP4. condition of road surface (including ice / water / mud / friction ideas); MP5. visibility factor (e.g. fog / dirty windscreen); MP6. speed of car; MP7. mass of car; MP8. kinetic energy of car; MP9. momentum of car;	allow 'thinking distance' allow 'braking distance' in the absence of MP2, MP3 and MP4	3

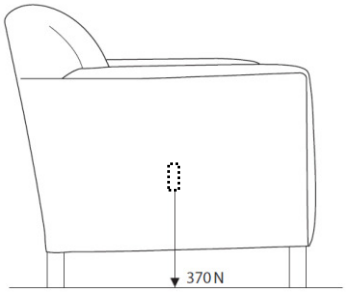
Total for question = 3 marks

Question number	Answer	Notes	Marks
4	MP1. find volume (of bolt); MP2. using displacement method; MP3. further detail of displacement method; MP4. correct use of density equation to find mass; MP5. further example of good practical technique;	MP2 MP3 MP5 can be awarded if seen on diagram e.g. • ensure bolt is fully submerged • measure volume of water before and after then find difference • (if using Archimedes can) ensure all displaced water is collected allow use of standard symbols e.g. • take repeats and average • use of appropriately sized measuring cylinder • make sure no water splashes out • read volume of water from bottom of meniscus • read at eye level to reduce parallax error	5

Total for question 4 = 5 marks

Question number	Answer	Notes	Marks
5 a	attempt to use 25%; scaling up to 1 week; evaluation; e.g. $1.2 \times 10^7 \times 0.25$ (= 3.0×10^6) (energy =) $3.0 \times 10^6 \times 7$ (energy =) 2.1×10^7 (J)	allow 25% or 0.25 seen anywhere allow x7 seen anywhere final answer of 3.0×10^6 or 8.4×10^7 gains 2 marks	3
b	any one from: MP1. idea of double/triple glazing; MP2. draw curtains; MP3. close windows; MP4. use of reflective film applied to windows;		1
c	any four from: MP1. air is a good insulator / poor conductor; MP2. conduction is reduced; MP3. fibreglass is a good insulator / poor conductor; MP4. (trapped) air cannot move around; MP5. convection (current) cannot form / is reduced;	ignore references to heat being trapped ignore unqualified 'air is trapped' as it is given in question	4
d	correct general shape i.e. one input and two outputs; reasonable correct proportions (by eye); correctly labelled;	 allow 'input, waste, useful' or 'chemical, thermal, thermal'	3

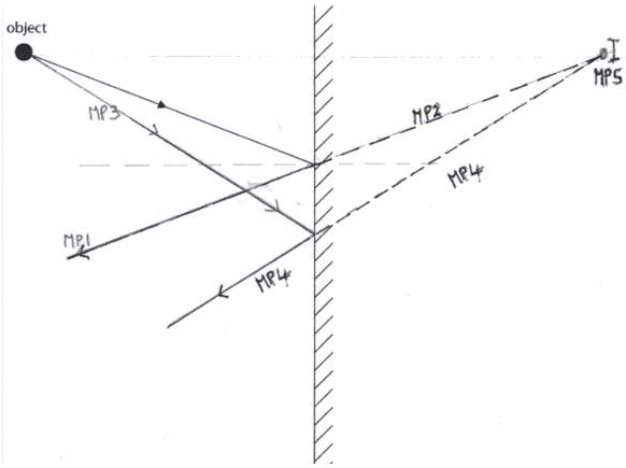
Total for question 5 = 11 marks

Question number	Answer	Notes	Marks
6 a	X drawn at the base of the weight arrow within area shown by the dashed box;  		1
b (i)	pressure = force ÷ area;	allow rearrangements and standard symbols e.g. p=F/A	1
(ii)	weight on each foot OR total area found; substitution; evaluation; matching unit; e.g. force on each foot = 92.5 (N) OR total area = 20.8 (cm^2) (pressure =) 92.5 / 5.2 OR 370 / 20.8 (pressure =) 18 N/cm^2	allow 92.5 or 20.8 seen anywhere in working allow any valid unit of pressure if no valid working seen 17.788…, 17.8 allow 10^4 Pa or 10^4 N/m^2 ignored factor of 4 gives 71 N/cm^2 gains 3 marks used 5.2^2 for area gives 3.4 N/cm^2 gains 3 marks used 5.2^2 for area and ignored factor of 4 gives 13.7 N/cm^2 gains 2 marks	4
c	MP1. (cups) increase (surface) area; MP2. force (on floor) remains the same; MP3. (since p=F/A) pressure (on floor) is decreased;	ignore 'force is more spread out' / eq	3

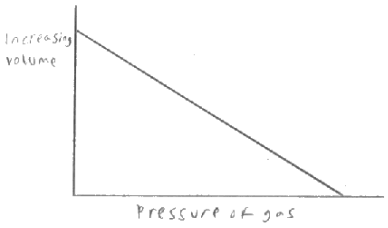
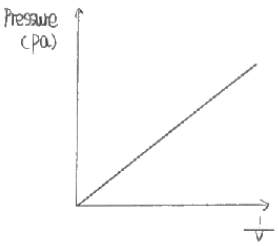
Total for question 6 = 9 marks

Question number	Answer	Notes	Marks
7 a (i)	moment = force x (perpendicular) distance;		1
(ii)	correct distance used; substitution; rearrangement; evaluation; e.g. distance = 40 (cm) 4.8 = force x 0.4 (force =) 4.8/0.4 (force =) 12 (N)	apply ecf if wrong distance chosen -1 for POT error 0.12, 16, 9.6 gain 3 marks 0.16, 0.096 gain 2 marks	4
b	use a longer spanner / apply force a greater distance from the {bolt / pivot} / apply a larger force; idea that force / distance needs to be 2x greater;	allow applying force at right angles to the spanner e.g. 12N applied at 80cm or 24N applied at 40cm	2

Total for question 7 = 7 marks

Question number	Answer	Notes	Marks
8 a	any four from: MP1. original ray reflected from mirror with i=r; MP2. reflected ray projected back behind the mirror along the same line; MP3. second ray drawn from the object to the mirror; MP4. second ray reflected correctly and projected back behind the mirror (such that it intersects the original ray projection); MP5. image labelled where the rays intersect;  	rays drawn do not need arrows judge reflection angle by eye line does not need to be dashed line does not need to be dashed allow this mark even if the intersection is in front of the mirror	4
b	virtual;	allow lateral inversion / imaginary / object'	1

Total for question 8 = 5 marks

Question number	Answer	Notes	Marks
9 a (i)	straight line extrapolated in line with existing line such that it crosses the temperature axis; temperature given in the range -260 to -300;	judge by eye	2
(ii)	(speed) increases / eq;		1
b (i)	temperature; mass / amount / type (of gas);	allow 'number of moles' allow moisture level / humidity (of gas)	2
(ii)	MP1. low volume gives high pressure / ORA; MP2. decreasing volume increases the pressure / ORA; MP3. relationship is non-linear / inversely proportional / idea that rate of change varies;  = 2 marks  = 3 marks	allow all marking points if seen from clear sketch graph with labelled axes N.B. 'pressure is inversely proportional to volume' gains all 3 marks Note that the following sketch graph would also gain all 3 marks  	3

Total for question 9 = 8 marks

Question number			Answer	Notes	Marks
10	a		any two from: MP1. comets orbit the Sun but moons orbit planets; MP2. moons have (approximately) circular orbits but comets have elliptical orbits; MP3. a comet has variable speed but a moon's speed is (approximately) constant;	 allow 'comet orbits are more elliptical'	2
	b	(i)	gravitational potential energy = mass x *g* x height;	allow rearrangements and standard symbols e.g. GPE = mgh reject 'gravity' for *g*	1
		(ii)	substitution; rearrangement; evaluation to more than 1 significant figure; e.g. 2.2 = 0.75 x 1.6 x height (height =) 2.2 / (0.75 x 1.6) (height =) 1.83333…	 award 2 marks max. if mass not converted to kg giving 0.00183	3
		(iii)	2.2 (J);		1
		(iv)	any three from: MP1. gravitational field strength is greater on the Earth; MP2. (therefore) hammer has a greater weight on Earth; MP3. (therefore) astronaut has to apply a greater force (to lift the hammer); MP4. hammer gains more GPE on Earth;	 allow use of *g* = 10 in calculation condone 'gravity is more on Earth' ORA allow 'downward force greater' condone 'hammer is heavier' GPE on Earth is 15J gains MP1 and MP4	3
	c		substitution; rearrangement; evaluation of time period; evaluation of number of orbits; e.g. $7.66 = \frac{2\pi \times 6780}{T}$ $(T =) \frac{2\pi \times 6780}{7.66}$ (T =) 5560 (s) (number of orbits = (24x60x60) / 5560 =) 15.5	allow method of finding total distance travelled and dividing by distance of one orbit ($2\pi r$) 5561 allow 15, 16	4

Total for question 10 = 14 marks

Question number	Answer	Notes	Marks
11 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. mark card/move compass/multiple compasses idea of another line or lines added sprinkle (iron filings) tap card (to distribute iron filings)	all marks may be given from a clearly labelled diagram	3
b	(lines are) parallel; (lines are) evenly spaced;	ignore references to lines being straight	2
c (i)	idea that wire cuts magnetic field lines; voltage is induced;		2
(ii)	any two from: MP1. move wire faster; MP2. coil wire into loops; MP3. use stronger magnets / magnetic field;	ignore references to using a different wire condone 'more coils / turns' allow move magnets closer together	2

Total for question 11 = 9 marks

Question number	Answer	Notes	Marks
12	any three from: MP1. pollen grain changes direction; MP2. (due to) collisions; MP3. by {smaller / tiny / water / invisible} particles; MP4. (this is) Brownian motion;	allow random motion	3

Total for question 12 = 3 marks

<table>
<tr><th colspan="2">Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>13</td><td>a</td><td>Geiger(-Muller) tube/detector;

clock / counter / stopwatch;</td><td>‘Geiger counter’ on its own gets 1 mark only</td><td>2</td></tr>
<tr><td></td><td>b (i)</td><td>source 1 line correct;
source 2 line correct;
source 3 line correct;;

<table><tr><th></th><th>Alpha</th><th>Beta</th><th>Gamma</th></tr><tr><td>Source 1</td><td></td><td></td><td>✓</td></tr><tr><td>Source 2</td><td></td><td>✓</td><td></td></tr><tr><td>Source 3</td><td>✓</td><td>✓</td><td></td></tr></table></td><td>one mark for each correct tick for source 3
-1 if all three types ticked</td><td>4</td></tr>
<tr><td></td><td>(ii)</td><td>(due to) background radiation;</td><td></td><td>1</td></tr>
<tr><td></td><td>c (i)</td><td>time taken;

and either of
• for (radio)activity to halve;

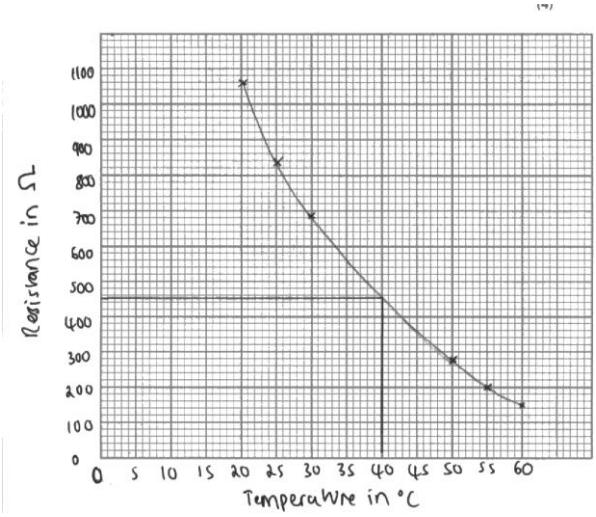
• for half of (radioactive) nuclei / atoms / isotope to decay;</td><td>allow
how long it takes
reject ‘half the time’

allow count rate for activity
reject:
• particles
• molecules
• substance
• ‘break down’
• ‘reactivity’
• a nucleus / an atom
• halve in mass
• to completely/fully decay</td><td>2</td></tr>
<tr><td></td><td>(ii)</td><td>count after one half-life found;
idea of it taking 3 half-lives;
correct evaluation of time;

e.g.
after 1 half-life, count = 390
after 3 half-lives, count = 97.5
(time = 3 x 6 =) 18 (days)</td><td>award full marks for answer of 17.78… days</td><td>3</td></tr>
</table>

Total for question 13 = 12 marks

Question number			Answer	Notes	Marks
14	a		C;		1
	b	(i)	(independent) temperature; (dependent) resistance;	must be this way round	2
		(ii)	label on both axes with units; scale on both axes; plotting;;	ignore orientation sensible linear scale using ≥50% of the grid tolerance is +/- 0.5 square -1 for each error	4
		(iii)	suitable curve passing no more than 1 square from any point;		1
		(iv)	value in the range 420 – 480 (Ω)	allow ecf from line drawn in (iii) ± 1/2 sq	1
		(v)	any three from: MP1. idea of thermometer reading being the actual temperature of the thermistor; MP2. measure a greater range of temperatures; MP3. take readings to fill in the gap in the temperature range; MP4. idea of measuring temperature/resistance to greater precision; MP5. take repeats AND average;	e.g. • position thermometer closer to the thermistor • position thermometer at the same height as the thermistor • placing thermistor at the bottom (of the beaker) • stirring the water allow 'measure for higher temperatures' etc. allow 'measure more temperatures' in the absence of MP2 and MP3 allow use a temperature sensor and data logger more sensitive / digital thermometer	3



Temperature in °C	Resistance in Ω
60	150
55	200
50	280
30	690
25	840
20	1060

c	(i)	voltage = current x resistance;	allow rearrangements and standard symbols e.g. V = I x R reject c/C for current	1
	(ii)	substitution AND rearrangement; evaluation to 2 or more significant figures; e.g. (current =) 6.10 / 1060 (current =) 0.00575 (A)	allow ecf from (i) allow 5.75 mA 0.0058 (A)	2
	(iii)	resistance decreases; voltage stays the same; (I=V/R therefore) current increases;		3

Total for question 14 = 18 marks

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