

Science (Physics) 5086 – Set IV

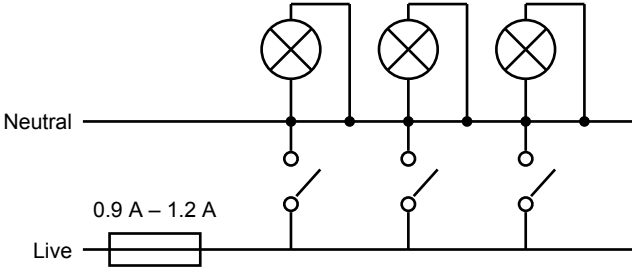
Answer Key

Compiled from the worked script: the paper carries no separate marking scheme, so each answer below is taken from the answer written into its answer space, with the mark allocation shown on the paper. The Paper 1 answers follow as a grid, read from the annotated multiple-choice paper printed with the source.

Paper 2 – Section A

Qn		Answer	Marks
1	(a)	Distance travelled = Area under s-t graph. Distance travelled = $(10 \times 8) + (\frac{1}{2} \times 5 \times 5) + (2 \times 5)$ $= (80) + (12.5) + (10)$ $= \underline{102.5 \text{ m}}$	[2]
	(b)	Average acceleration = (Final speed – Initial speed) / time taken $= (15 - 10) / (6 - 1)$ $= 5 / 5$ $= \underline{1 \text{ m/s}^2}$	[2]
	(c)	Average speed = Total distance / total time taken $= 102.5 / 8$ $= \underline{12.8 \text{ m/s}}$ (3 s.f.)	[1]
2	(a)	$F = ma$ $= 5.0 \times 2.0$ $= 10 \text{ N}$	[2]
	(b)	$F - f = ma$ $15 - f = 10$ $f = 15 - 10$ $= 5.0 \text{ N}$	[2]
	(c)	$a = (v - u) / t$ $2.0 = (v - 0) / 4.0$ $v = 8.0 \text{ m/s}$	[2]
3		Since object is in equilibrium, sum of anti-clockwise moment = clockwise moment $F \times 1 = (50 \times 10) \times (0.4/2)$ $F = 100 \text{ N}$	[3]
4	(a)	$E_p = mgh = 48 \times 10 \times (2.2 + 0.9)$ $= 1488 \text{ J}$	[2]
	(b)	$E_k = E_p \text{ at top} - E_p \text{ at bottom}$ $= 1488 - 48 \times 10 \times (2.2 - 0.9)$ $= 864 \text{ J}$	[2]
	(c)	$E_k = \frac{1}{2} \times 48 \times v^2$ $864 = \frac{1}{2} \times 48 \times v^2$ $v = 6 \text{ m/s}$	[2]
5	(a)	It is the constant temperature at which the substance changes from liquid to gaseous state.	[1]
	(b)	During BC, the forces of attraction decreases / overcome [1] and the speed of the molecules remain constant. [1]	[2]

	(c)	Energy = $500 \text{ W} \times 15 \times 60$ [1] = $450\,000 \text{ J}$ [1]	[2]												
6	(a)	<table border="1"> <thead> <tr> <th></th><th>alpha (α)</th><th>beta (β)</th><th>gamma (γ)</th></tr> </thead> <tbody> <tr> <td>least penetrating</td><td>✓</td><td></td><td></td></tr> <tr> <td>most penetrating</td><td></td><td></td><td>✓</td></tr> </tbody> </table>		alpha (α)	beta (β)	gamma (γ)	least penetrating	✓			most penetrating			✓	[1]
	alpha (α)	beta (β)	gamma (γ)												
least penetrating	✓														
most penetrating			✓												
	(b)(i)	the emission of beta-particles during radioactive decay is random in direction so it may not enter the detector.	[1]												
	(b)(ii)	time between emissions is unpredictable / emission cannot be controlled / affected by outside influences.	[1]												
	(b)(iii)	time taken for the radioactive nucleus to decay by half.	[1]												
7	(a)	$(30 - 0) / 2 = 15 \text{ cm}$	[1]												
	(b)	$V = f \times \lambda$ $= (20/5) \times 60$ $= 240 \text{ cm/s}$	[2]												
8	(a)	Effective resistance = $2 + (1/1 + 1/3)^{-1}$ = $2.75 \, \Omega$	[2]												
	(b)	$V = IR$ $Q = It$ $9 = I (2.75)$ $= 3.27 \times 60$ $I = 3.27 \text{ A}$ $= 196 \text{ C}$	[2]												
	(c)	$V = W/Q$ $3.27 \times 2 = W/196$ $W = 1280 \text{ J}$	[2]												
9	(a)	current in the straight wire is downwards	[1]												
	(b)	By the FLHR, when the current is downwards (1) and the magnetic field is pointing from left to right (1), there is a force exerted on the wire in a direction out of the page or away from magnet (1).	[3]												
	(c)	When the rheostat is fixed at Y, the resistance in the circuit is lowest, hence current is highest (1). The straight wire will produce a stronger magnetic field around the straight wire (1) and hence a larger force pushing (1).	[3]												
10	(a)	Earth wire	[1]												
	(b)	Outer casing is made from plastic which is an insulator. Hence earth wire is not needed since user will not be electrocuted when touching the casing	[2]												
	(c)	$I = P/V = 60/240 = 0.25 \text{ A}$ The fuse should be rated slightly above 0.25 A, at 0.3 A.	[2]												
	(d)	$1 \text{ h} \rightarrow 60 \text{ W} = 0.06 \text{ kW}$ $24 \text{ h} \rightarrow 0.06 \text{ kW} \times 24 = 1.44 \text{ kWh}$ $1 \text{ kWh} \rightarrow 0.25 \, \phi$ $1.44 \text{ kWh} \rightarrow 0.25 \, \phi \times 1.44 \text{ kWh} = \0.36	[2]												

	(e)		[3]
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Section B

11	(a)(i)	Refraction / Speed of light decreases when it travels from air into the lens.	[1]
	(a)(ii)	$n = \sin i / \sin r$ $= \sin 40 / \sin 25$ $= 1.52$	[2]
	(a)(iii)	* suitable scale e.g. 1 cm : 2 cm * correct drawing – rays with arrows included * answer between 6.4 cm to 6.8 cm	[3]
	(a)(iv)	real, inverted and diminished	[1]
	(b)(i)	Construction lines added to locate the reflected image, position labelled I.	[1]
	(b)(ii)	Position O of the object marked on the diagram.	[1]
	(b)(iii)	Ray diagram completed to show the two rays emerging from the object.	[1]
12	(a)(i)	When the heating coil will heat up the water around it via conduction. The heated water expands and becomes less dense, and rises (1) to the top of the kettle. Cooler and denser water at the top of the kettle sinks to replace the heated water (1). Thus a convection current is set up (1).	[3]
	(a)(ii)	Shiny and smooth surfaces are poor emitters of radiation/heat. Thus the outer surface of the kettle loses heat slowly and helps to retain heat in the kettle. (Do not accept poor absorbers)	[2]
	(a)(iii)	Plastic is a poor conductor of heat as compared to metal. Heat from the hot metal kettle cannot be transferred readily to the handle and thus the user can hold the kettle easily.	[2]
	(b)(i)	Near the spout of the kettle, steam is emitted at a high speed. Being less dense than the surrounding air, it rises vertically. The fast uprising steam collides with the water droplets and hence the latter also rises vertically.	[2]
	(b)(ii)	This is Brownian motion which occurred further away from the spout of the kettle, whereby the water droplets are continuously bombarded by random moving air molecules.	[1]

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Paper 1 – Multiple Choice

1	2	3	4	5
A	D	D	C	B
6	7	8	9	10
D	B	B	D	A
11	12	13	14	15
B	D	B	B	D
16	17	18	19	20
B	C	B	A	B

Read from the annotated copy of Paper 1 supplied with the paper, on which the correct option of each question is highlighted.