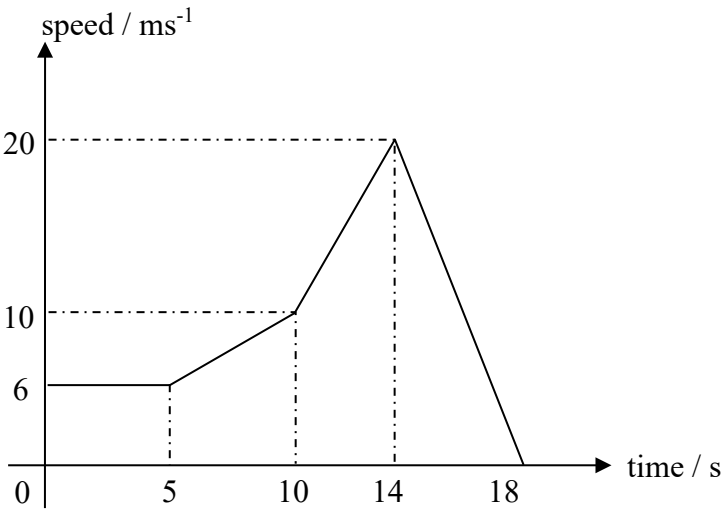
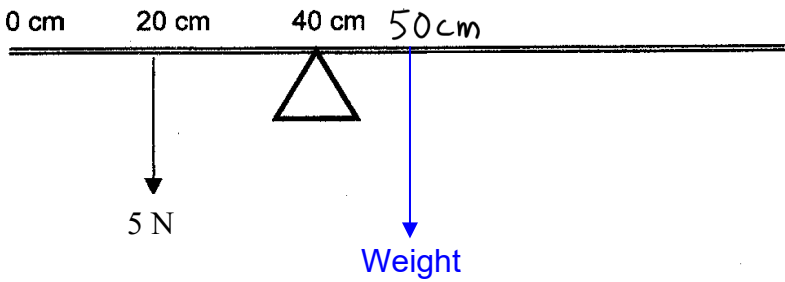
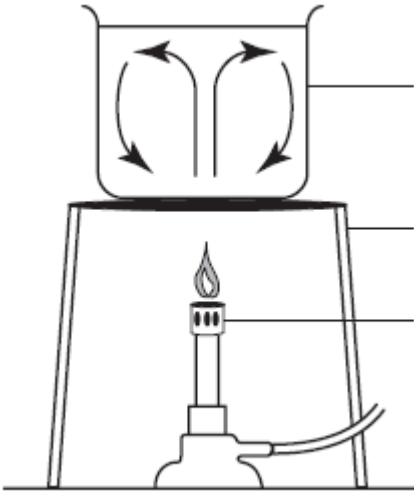


NGEE ANN SECONDARY SCHOOL
Sec 4 Express
Science(Physics) 5086
Preliminary Examination 2024
Marking Scheme

Paper 2 Section A – Structured Questions (55 marks)

1	(a)	Acceleration is greater during the time from the 10 th second to the 14 th second than the time from the 5 th second to the 10 th second.	B1
	(b)	Acceleration = gradient = 10/4 = 2.50 m/s ²	M1 A1
	(c)		B1 – negative uniform gradient
	(d)	Distance = area under graph = (5×6) + [1/2(6+10)×5] = 70.0 m	M1 A1
Total			6
2	(a)	$F - f = ma$ $12\,000 - 3200 = 2400a$ $8\,800 = 2400a$ $a = 3.67 \text{ m/s}^2$	M1 A1
	(b)	The retarding force continues to <u>increase due to air resistance until it balances the forward force.</u> When the <u>total retarding force is equal to the driving force,</u> <u>resultant force is zero</u> and the bus moves at <u>constant speed.</u>	B1 B1
Total			4

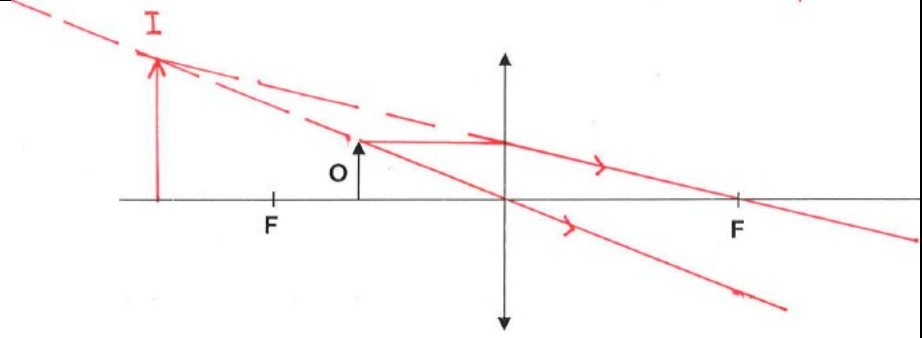
3	(a)	 B1 – Correct labelled 50 cm mark B1 – Correct weight drawn acting vertically down at 50cm mark	
	(b)	By Principle of Moments, taking moments about the pivot, sum of clockwise moment = sum of anticlockwise moment $W \times 0.1 \text{ m} = 5 \times 0.2 \text{ Nm}$ $W = 10.0 \text{ N}$	M1 A1
		Total	4

4	(a)	Conduction	B1
	(b)	(i) 	B1
		(ii) Water at the bottom gets <u>heated</u> and <u>expands</u>, <u>decreases in density</u> and <u>rises</u> to the top. <u>Cooler</u> surrounding water that has <u>higher density</u> <u>sinks</u> in to take its place. This sets up a <u>convection current</u> to transfer heat throughout the liquid.	B1 B1

	(c)		<table><tr><td></td><td>Intermolecular forces</td><td>Spacing/Distance between molecules</td></tr><tr><td>Water</td><td>strong</td><td>Close together</td></tr><tr><td>Water vapour</td><td>weak</td><td>Far apart</td></tr></table>		Intermolecular forces	Spacing/Distance between molecules	Water	strong	Close together	Water vapour	weak	Far apart	B1 B1
	Intermolecular forces	Spacing/Distance between molecules											
Water	strong	Close together											
Water vapour	weak	Far apart											
			Total	6									

5	(a)		The plastic stopper is a poor conductor of heat hence reduces heat loss by conduction. OR The stopper prevents warm air from escaping whereby preventing convection and evaporation from taking place.	B1
	(b)		Vacuum between double glass wall prevents convection/conduction as convection/conduction requires a medium to take place.	B1
	(c)		The wall of the glass is silvered so that infra-red radiation is reflected back to the liquid. OR Silver is a poor emitter of heat hence heat is radiation away slowly.	B1
			Total	3

6	(a)		Amplitude = 0.400 m	B1
	(b)		Distance = $1.2(3) = 3.60$ m	B1
	(c)		Wavelength = $3.6/3 = 1.20$ m	B1
			Total	3

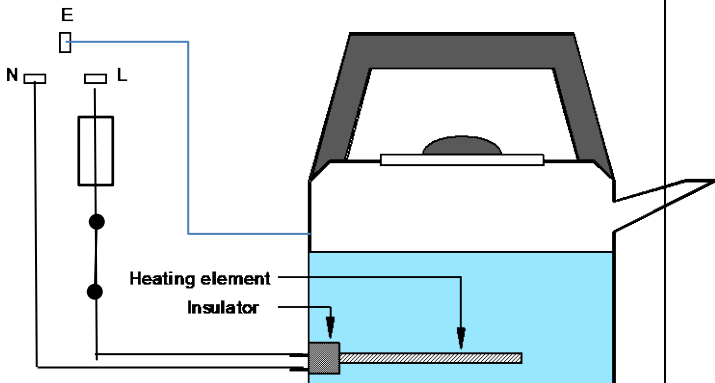
7	(a)		 B1 – 2 rays drawn correctly B1 – Image drawn upright correctly with label I	
	(b)		Upright and magnified or virtual	B1
			Total	3

8	(a)		3 correct forces drawn and labelled [B2] minus [1] for each force missing
	(b)	Sphere S is negatively charged and unlike charges attract.	B1
Total			3

9	(a)	Sound waves travels as a longitudinal wave where the particles' vibration is parallel to the direction of wave travel. OR Sound wave travels as a series of compression and rarefaction	B1
	(b)	Speed of sound = $2d/t$ (with formula) = $2 \times 540/0.58$ = 1860 ms^{-1} (to 3 sf)	M1 A1
	(c)	No effect	B1
Total			4

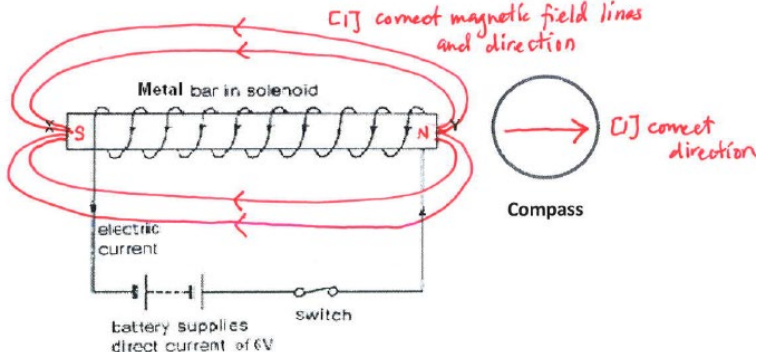
10	(a)	$R_T = 2 + (1/3 + 1/1)^{-1} + 4$ = 6.75Ω	M1 A1
	(b)	$I = V/R$ (with formula) = $5/6.75$ = 0.741 A	M1 A1
	(c)	$Q = I \times t$ (with formula) = $0.741 \times 1 \times 60$ = 44.5 C	M1 A1
Total			6

11	(a)		All points plotted to within $\frac{1}{2}$ small square and Smooth curve joining all points	B1
	(b)		1.5 $\pm$ 0.1 days (unit necessary) Lines or other markings on graph to show at least TWO half lives have been used to determine the answer.	B1 B1
			Total	3

12	(a)		Total power on = $500 + 120 + 250 + 12000$ $= 12870 \text{ W}$ Total energy used in $\frac{1}{2}$ hour = $(12870 \times \frac{1}{2})/1000$ $= 6.435 \text{ kWh}$ Money wasted = 6.435×0.28 $= \\$1.80$	M1 M1 A1
	(b)	(i)	2 m for all 3 wires connected correctly, 1 m for at least 2 wires correctly connected, no marks for either 1 or no wires connected correctly 	B1 B1
		(ii)	1m for both fuse and switch correctly connected	B1
		(iii)	When current <u>exceeds the fuse rating</u> , the fuse will <u>melt and break the circuit</u> , hence preventing the large current from reaching the appliance.	B1
		(iv)	$P = IV$ $I = P/V$ (with formula) $= 2000/240$ $= 8.33 \text{ A}$ Current in live wire = 8.33 A Current in earth wire = 0 A	M1 A1 A1
			Total	10

Paper 2 Section B – Essay Questions (20 marks)

13	(a)		Principle of Conservation of energy states that energy cannot be created or destroyed but gets converted from one form to another. Total energy remains constant	B1 B1
	(b)		Kinetic energy upon impact = loss in gravitational potential energy $= mgh$ $= 300 \times 10 \times 2$ $= 6\,000 \text{ J}$ There is no energy lost to the surroundings. All the GPE is converted to KE just before impact.	M1 A1 B1
	(c)		GPE gained after impact = 0.7×6000 $= 4\,200 \text{ J}$ $\begin{aligned} mgh &= 4200 \\ 300 \times 10 \times h &= 4200 \\ h &= 4200/3000 \\ &= 1.40 \text{ m} \end{aligned}$	M1 M1 A1
	(d)		Power lost = energy / time $= (6000 - 4200) / 0.01$ [ecf from (b) and (c)] $= 1800 / 0.01$ $= \underline{180\,000 \text{ W}}$ OR : Power lost = $(0.3 \times 6000) / 0.01$ [ecf from (b)] $= \underline{180\,000 \text{ W}}$	M1 A1
			Total	10

14	(a)	Soft Iron	B1
	(b)	- Increase number of turns of the coil - Increase the current	B1 B1
	(c)	South	B1
	(d) (e)	 B1 – Correct magnetic field lines drawn B1 = Correct compass direction	
	(f)	When a high current passes from X to Y, the <u>electromagnet becomes strongly magnetised.</u> It <u>attracts the iron latch</u>, causing the compressed spring attached to the safety bar to move to the right and break the circuit. The circuit breaker can be reset by pushing the safety bar back when the current stops flowing and the iron latch is no longer attracted to the solenoid.	B1 B1 B1
	(g)	Moving-coil loudspeaker/ammeter/circuit breaker/used in scrapyards to separate magnetic materials from non-magnetic materials	B1
		Total	10