

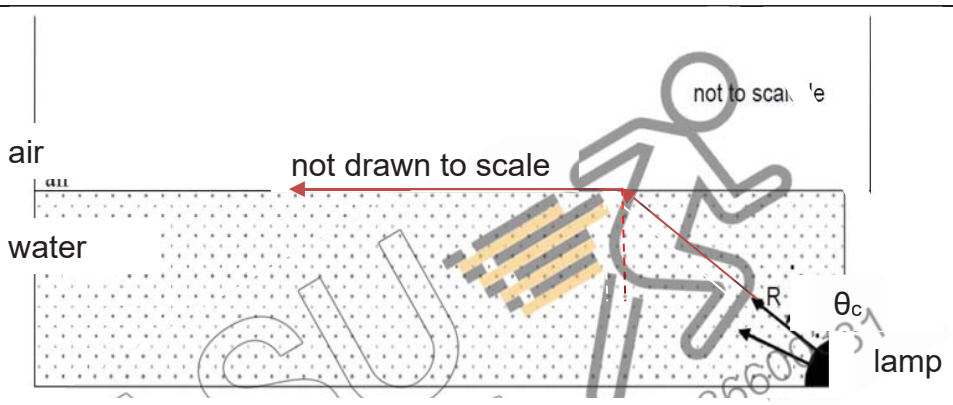
ADMIRALTY SECONDARY SCHOOL

4E PPhy 6091 Prelims 2019 Marking Scheme

1.	B	2.	A	3.	B	4.	C	5.	A	6.	D	7.	A	8.	A	9.	B	10.	A
11.	B	12.	A	13.	A	14.	C	15.	D	16.	A	17.	D	18.	D	19.	C	20.	C
21.	C	22.	C	23.	C	24.	C	25.	A	26.	D	27.	A	28.	A	29.	B	30.	C
31.	D	32.	B	33.	A	34.	B	35.	B	36.	A	37.	D	38.	B	39.	D	40.	C

Paper 2 Section A

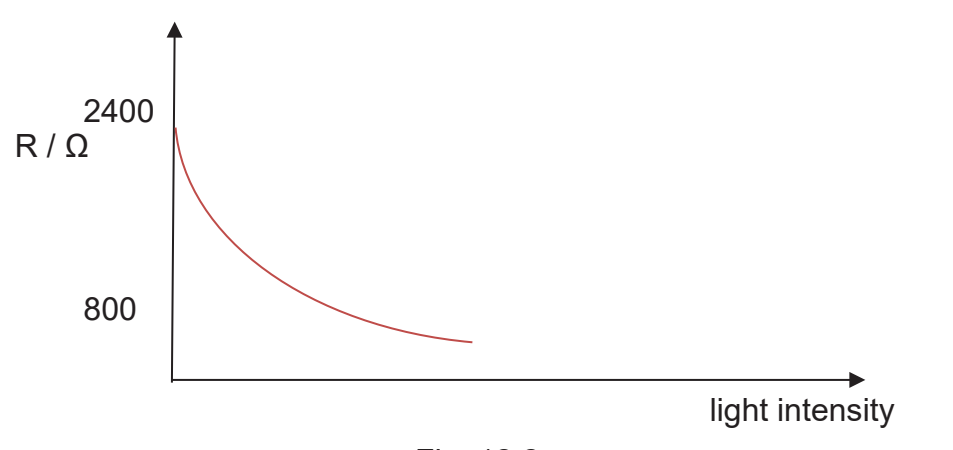
Qn No	Answers	mks	
1	(a)	Total distance = area under graph = $0.5 \times 64 \times 50$ = 1600 m	[1] [1]
	(b)	Gravitational field strength = acceleration on planet X = $64 / 32$ (or equivalent for gradient of graph) = 2.0 N/kg or 2.0 ms^{-2}	[1] [1]
	(c)	Weight = mass x gravitational field strength = 150×2 = 300 N	[1] [1]
2	(a)	Gravitational potential energy = mgh = $(200 \times 1000) \times 10 \times 1.2$ = 2400 000 J Power required = $2\,400\,000 \times 100 / 80$ = 3 MW	[1] [1] [1]
	(b)	Water needs to be raised higher than the sea level to be discharged Water cannot be drawn from the surface of the water from the reservoir / water is drawn from below the water surface Energy may be lost to friction in the process Hence the height difference is greater than 1.2m, resulting in the higher power input needed.	[2]
3	(a)	Movable weight exerts a clockwise moments and keeps the safety valve closed. When the steam is excessive, it will exert a large force on the safety valve, exerting an anti-clockwise moment. When the anti-clockwise moment from the steam is greater than the clockwise moment, steam releases from the safety valve.	[1] [1] [1]
	(b)	Clockwise moments = anti-clockwise moments $400 \times 75 = F \times 10$ $F = 3000 \text{ N}$	[1] [1]
	(c)	Lower the weight of the movable weight Move the movable weight closer to the pivot Increase the surface area of the safety valve Shift the pivot to the right (any 1) To reduce the clockwise moments	[1] [1]
4	(a)	$P = h\rho g$ = $0.15 \times 1200 \times 10$ = 1800 Pa	[1] [1]
	(b)	$P = h\rho g$ $1800 = 0.24 \times \rho \times 10$	[1]

		750 kg / m ³ = ρ	[1]
5	(a)	Layer of air in the gap Air is a poor conductor of heat, hence reducing heat conducted to hand Or less contact area with the hand. less surface area results in less conduction from the cup to the hand, hence the person holding the cup will feel less hot.	[1] [1]
	(b)	Coffee in corrugated cardboard Poor conductor of heat compared to ceramic, where the molecules are more closely packed together as solid, than gas.	[1] [1]
6	(a)	$v=c/n$ $= 3 \times 10^8 / 1.33$ $= 2.26 \times 10^8 \text{ m/s}$	[1] [1]
	(b)	 <p>$n=1 / \sin c$ $1.33 = 1/ \sin c$ $c= 48.8^\circ$</p>	[1] [1] [1]
7	(a)	Paint droplets repel one another Spreads out uniformly to cover more area with same amount of paint	[1] [1]
	(b)	Metal panel would be positively charged due to conduction and repel other paint droplets.	[1] [1]
8	(a)	Earth wires connects to the metal casing. In the event that the live wire accidentally touches the metal casing, causing it to go 'live', the earth wire conducts away to earth, preventing electric shock from the user who touches the metal casing	[1] [1]
	(b)	Fuse should not be at neutral / should be at live wire In case of excessive current, the fuse may blow but the appliance might still be 'live'.	[1] [1]
	(c)i	Total energy = $2.4 \times 10/60 \times 30$ $= 12 \text{ kWh}$ Cost = $12 \times \$0.2 = \2.40	[1] [1]
	(c)ii	$P = V^2/R$ $2400 = 220^2 / R$ $R = 20.2 \Omega$ $P = 110^2 / 20.2$ $= 600 \text{ W}$	[1] [1]

9	(a)i	Increase number of coil on the secondary coil	[1]
	(a)ii	Iron is easily magnetised and demagnetised Ensuring better magnetic flux linkage between the 2 coils. Steel does not magnetise or demagnetise easily. It is the change of magnetic flux that is able to induce a current, and hence an induced emf, in the secondary coil.	[1] [1]
	(b)i	$V_p I_p = V_s I_s$ $240 \times 13 = (240 \times 100) \times I_s$ $I_s = 0.13 \text{ A}$	[1] [1]
	(b)ii	Reduce energy loss during transmission Since heat loss is $P = I^2 R$, the lower the current, the lower the energy loss during transmission.	[1] [1]

Section B Structured Answers			
10	(a)	Although the mass of the people in the car doubled, the total mass only increased slightly, hence by $F = ma$, the acceleration did not decrease by half.	[1]
10	(b)	Time = speed / acceleration = 50 / 3.25 = 15.4 s	[1] [1]
	(c)	$F = 990 \times 3.25 = 3217.5 \text{ N}$ OR $F = 920 \times 3.50 = 3220 \text{ N}$	[2]
	(d)i	Rate of decrease of velocity is constant.	[1]
	(d)ii	Distance travelled = $0.5 \times 50 \times (12-2)$ = 250 m	[1] [1]
	(d)iii	Before applying the brakes, the distance between the car and the police car decreases by 50m per second. After applying the brakes, the distance between the car and the police car decreases by less than 50m per second.	[1] [1]
11	(a)i	When water evaporates, the liquid molecules vibrate randomly at different speeds, Molecules at the surface that have enough energy to overcome the downward attractive forces of other molecules will leave the surface.	[1] [1]
	(a)ii	Molecules in steam move at high speed while molecules in water moves at slow speed. OR Molecules in steam is at boiling point, while molecules in water in not at boiling point OR Molecules in steam are far apart from each other but molecules in water are closely packed together	[1]
	(b)i	Reduce heat gain by liquid nitrogen through conduction. Vacuum does not conduct as it removes the medium, which is required for conduction to take place, hence keeping the liquid nitrogen in liquid state.	[1] [1] [1]
	(c)i	$Q = mc \Delta\theta$ = $50 \times 0.39 \times (-196-20)$ = 4212 J	[1] [1]
	(c)ii	$Q = ml_v$ 4212 = $m(200)$ M = 21.1 g	[1] [1]

12 Either			
	(a)	3.0 V	[1]
	(b)	$\frac{1}{\text{total } R} = \frac{1}{150 + 150} + \frac{1}{800 + 1200}$ R = 261 Ω	[1] [1]
		V = IR 6 = I (261)	[1]

		$I = 0.023 \text{ A}$	[1]
	(c)	 <p style="text-align: center;">Fig. 12.2</p>	[1]
	(d)i	$V = 2400 / 3600$ $= 4.0 \text{ V}$	[1] [1]
	(d)ii	X to Y X has a greater potential of 3.0 V than Y at 2.0 V.	[1] [1]

12 Or		
(a)	Faraday's Law of electromagnetic induction states that the magnitude of the induced EMF in a circuit is directly proportionate to the rate of change of magnetic flux in the current.	[1]
(b)	When the string vibrations, the magnetic flux linking the coil changes. The change in magnetic flux generates an induced current. The induced current creates an induced emf in the coil, causing the signal to be generated.	[1] [1] [1]
(c)	No signal will be generated. There is no change of magnetic flux as nylon is not an electrical conductor.	[1] [1]
(d)i	Period = 8 ms Frequency = $1 / 0.008$ = 125 Hz	[1] [1]
(d)ii	Frequency remains the same Amplitude of the sound wave increases.	[1] [1]

Paper 3

1	(a)i	L = 2.5 cm d = 1.4 cm	[1]
	(a)ii	It is the diameter of a circle, and it is difficult to ensure that the measurement passes through the center of the circle, to take repeated reading from different sides and take the average. Or Difficult to determine the inner diameter, can use a inner jaw of Vernier calipers	[1]
	(a) iii	Disagree. $\pi(d/2)^2$ is the area of the circle, not circumference, <u>so</u> the total uncoiled length equation is not correct.	[1] [1]
	(b) i	L ₁ = 8.0 cm e = 5.5 cm	[1] [1]
	(b)ii	T = 0.17 x 5.5 = 0.935 N	[1]
	(c)i	A = 60.0 cm B = 40.0 cm C = 80.0 cm	[1]
	(c)ii	W _r (0.600) + 0.9 (0.400) = 0.935 W _r = 0.958 N (actual mass is 100g)	[1] [1]
2	(a)	60.0 cm (accept 58.0cm to 62.0cm, must be 1 dp)	[1]
	(b)i	27.1s (accept 25.0s – 30.0s)	[1]
	(b)ii	T = 1.36s T ² = (1.36) ² = 1.85 s ²	[1] [1]
	(c)	Human reaction time of starting and stopping of the stopwatch.	[1]
	(d)	Constant variable: mass of bob, distance between cork and table Description of experiment that will fulfil requirements Accurate results: take more readings then obtain the average / take time for more oscillations and then take the period. Graph of T ² vs h m is the gradient of the graph. H can be determined from substitution of values from a point on the best fit line	[1] [1] [1] [1] [1]
3	(a)	3.0 V or measured value	[1]
	(c)	d = 10.0 cm, I = measured value to precision of 2d.p. (precision of given ammeter)	[1]
	(d)	Measured value as per correct precision and units. d / mm , I / A , V / V , 1/I / A ⁻¹	[4]

(e)	Graph of d/mm (y-axis) vs $1/I / \text{A}^{-1}$ (x-axis) - axes Plot - plot Best fit line - graph More than half the page - scale	[1] [1] [1] [1]
(i)	Gradient = $(y_2 - y_1) / (x_2 - x_1)$ = 300 (accepted 200-500)	[1] [1]
(ii)	Using linear law, $y = mx + c$ Sub $d = 0$ (meaning $y = 0$ for the graph), use a selected point on the best fit line to find the I_0 .	[1] [1]
(iii)	500	[1]
(d)i	$R = 100 E / I_0 d_0$ (using values found above) = 10Ω (approx.)	[1] [1]
(d)ii	Kinks in the resistance wire	[1]
(d)iii	Take readings from portions of the wire that does not have kinks.	[1]
(e)	Graph with a steeper gradient	[1]

