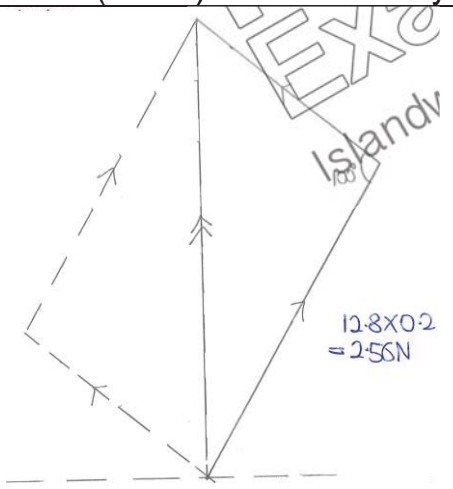
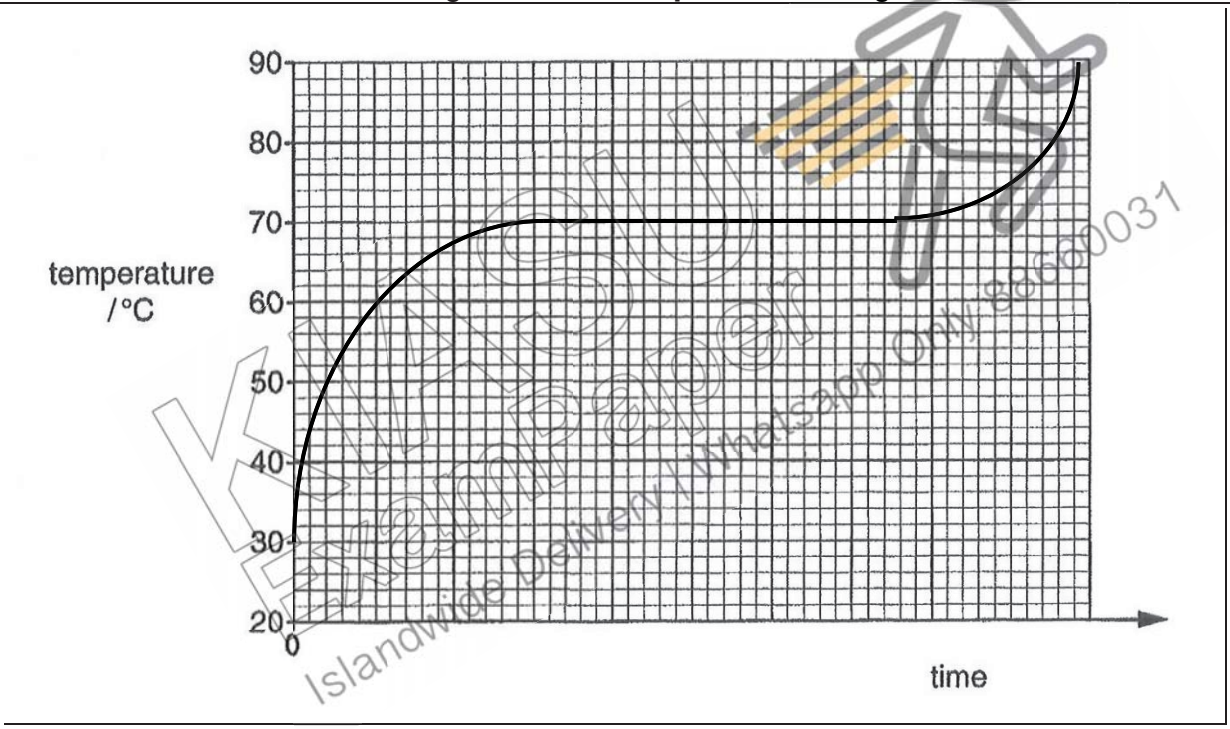
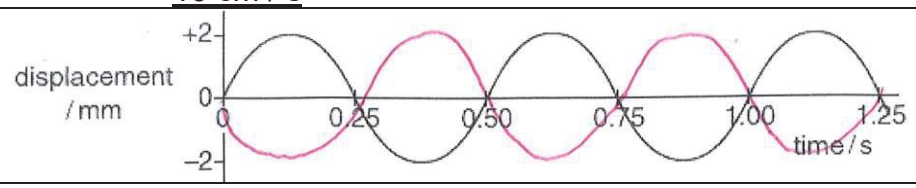
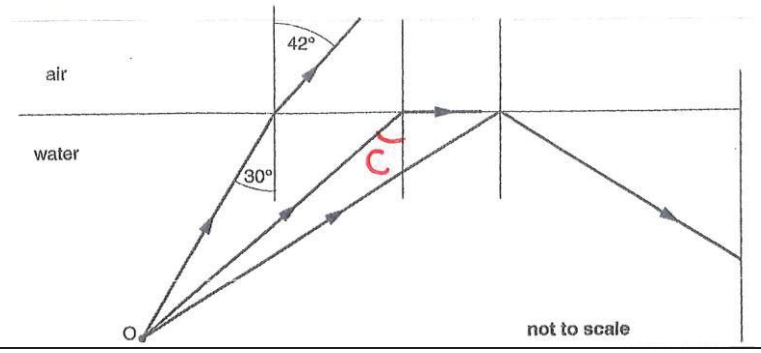
4E5A Science Physics EOY Answers
Paper 1: Multiple Choice Questions [20 marks]

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

Paper 2
Section A: Structured Questions [45 marks]

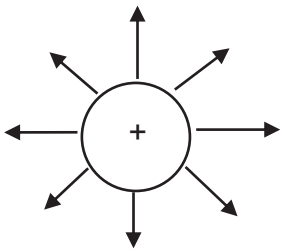
No.	Answer	Marks
1(a)	The driver's reaction time is 0.8 s because the car travels at a **constant speed** of 50 m / s during this period before the speed decreases as the driver applies the brake.	B1 B1
(b)	Total distance = Area under graph = (50 x 0.8) + (1/2 x 2.2 x 50) = 95 m	 M1 A1
(c)	Acceleration = (v – u) / t = (0 – 50) / 2.2 = -22.7 m/s^2 Deceleration = 22.7 m/s^2 Note: Students will be marked wrong if their working is (50 – 0) / 2.2 unless they stated d = -a.	 M1 A1
2(a)	 scale: 1 cm represents 0.2 N or 0.25 N Resultant force = 2.56 N (Accept between 2.52 N to 2.60 N)	B1 for correct parallelogram drawn with arrows B1 for resultant force with double arrow in the correct direction B1 A1
(b)	weight = 2.56 N or from (a) answer.	B1

3(a)	Volume of metal = (π x 1.25^2 x 0.15) – (π x 0.40^2 x 0.15) = 0.661 cm^3 (to 3 sf)	M1 A1
(b)	Density = mass / volume = 6.5 / 0.661 = 9.83 g / cm^3 (to 3 sf)	 M1 A1
(c)	9.83 g / cm^3 = 9830 kg / m^3	B1
4 (a)(i)	There is no moment due to tension in string S as the distance between the tension and pivot is zero.	B1 B1
(ii)	clockwise moment = anti-clockwise moment T x 1.20 = 180 x 0.8 T = 120 N	 M1 A1
(b)	anti-clockwise moment = clockwise moment T x 1.20 = 180 x 0.4 T = 60 N	 M1 A1
(c)	The sum of the tensions in strings R and S is **equal** to the weight of the rod.	B1
5(a)		1 mark for correct curve (positive gradient) 1 mark for horizontal line at 70 °C
(b)	70 °C	
(c)(i)	The arrangement of particles changes from slightly further apart in a liquid to very far apart in a gas.	B2
(ii)	The motion of particles changes from sliding against each other in a liquid to moving randomly at high speeds in a gas.	B2
6(a)	The wavefront is an imaginary line that joins all adjacent points that are in phase.	B1
(b)(i)	f = 1 / T = 1 / 0.50 = 2 Hz	 A1

(ii)	v = f x λ = 2 x 8.0 = 16 cm / s	M1 A1
(c)		B1
7(a)		
(b)	Refractive index = sin i / sin r = sin 42 / sin 30 = 1.34 (to 3 sf) Note: Students will be awarded 0 mark if they use sin 30 / sin 42 as their workings.	M1 A1
(c)	The light undergoes **total internal reflection [1]** as it travels from an **optically denser to less dense medium** because the **angle of incidence in the denser medium is greater [1] than the critical angle**.	B2
8(a)	Power = 3020 W (to 3 sf) Energy used per day = 1.51 kWh Note: Teacher can use this question to remind students to round off exact answers (with more than 3 sf) to 3 sf.	A2
(b)	$3.89 (to 3 sf)	A1
(c)	This is because the operating current for the water heater is 12.6 A. This larger current will cause the fuse to melt / blow immediately once it is switched on.	B1 B1

Section B: Free Response Questions [20 marks]

9(a)	The first ring is heard from **direct transmission** of sound from the bell to the student while the second ring is heard after the **reflection** of the sound from the steep mountain side.	B1 B1
(b)	time taken to hear 1st ring = d / v = 990 / 330 = 3 s time taken to hear 2nd ring = d / v = (3 x 990) / 330 = 9 s time interval = 9 – 3 = 6 s	 M1 M1 A1

(c)(i)	The loudness of the note is decreasing as the amplitude is decreasing.	B2
(ii)	Period T = 1 / f = 1/ 250 = 0.004 s Initial amplitude is 5 units. Hence, half the amplitude is 2.5 units. No. of oscillations for amplitude to decrease by half = 12 Hence, time taken = 12 x 0.004 = 0.048 s	 M1 M1 A1
10 (a)(i)	Electric field is a region in which an electric charge experiences an electric force.	B1
(ii)		B1
(iii)	The dust particles becomes **negatively charged** as it **gains electrons** from the fine wire. Since **unlike charges attract**, it would then be **attracted to the positively charged plates**.	B2 B1
(b)(i)	Resistance of parallel circuit = $(1/6 + 1/3)^{-1}$ = 2 kΩ Effective resistance = 2 + 8 = 10 kΩ (shown)	 A1
(ii)	Current I = V / R_{total} = 6 / 10 000 = 0.0006 A or 6 x 10^{-4} A Note: Award 1 mark for student working if they show 6 / 10.	 M1 A1
(iii)	Current I = 1/3 x 0.0006 = 0.0002 A	M1 A1
11(a)	He is moving in a horizontal circle, thus there is a **change in the direction of motion** or change in velocity.	B1
(b)	The greater the speed, the greater the force. The smaller the radius, the greater the force. As the speed increases the rate of change in force increases	B1 B1
(c)(i)	Change in force = 16 000 – 4 000 = 12 000 N Dotted lines shown on the graph.	 A1 B1
(ii)	Distance moved by astronaut = π x d = π x (2 x 8) = 16π m Work done on astronaut = F x d = 36 000 x 16π = 1.81 x 10^6 J (to 3 sf)	 M1 M1 A1
(iii)	Kinetic energy = ½ mv^2 = ½ x 90 x 60^2 = 162 000 J	M1 A1