

4E5N SCPHY PRELIM 2020 MARKING SCHEME**Paper 1**

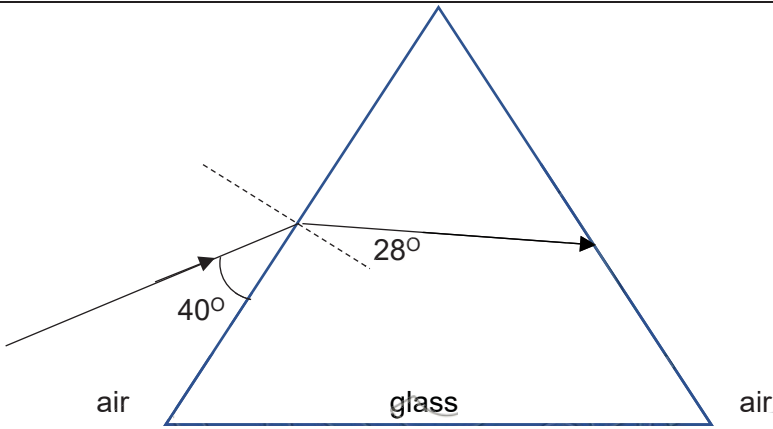
1	A	11	C
2	A	12	D
3	D	13	C
4	B	14	A
5	B	15	B
6	A	16	B
7	C	17	B
8	B	18	D
9	C	19	C
10	C	20	D

Paper 2

1	Correct magnitude of forces Correct direction of forces	[1] [1]
	Magnitude of resultant force Direction of resultant force	[1/2] [1/2]
2(a)	GPE at P = $mgh = 2 \times 10 \times 0.8 = 16 \text{ J}$	[1]
2(b)	KE at P = $\frac{1}{2}mv^2 = \frac{1}{2} \times 2 \times 1.5^2 = 2.25 = 2.3 \text{ J}$	[1]
2(c)	$16 + 2.25 = 18.25 \text{ J}$	[1/2]
	$18.25 - 10.3$ $= 7.95 \text{ J}$ $= 8.0 \text{ J}$	[1/2]
2(d)	$W = F \times d$ $7.95 = F \times 25$ $F = 0.318 \text{ N}$ $= 0.32 \text{ N}$	[1] [1]
3(a)	110 N at 80 cm mark	[1]
3(b)	CW moment $= F \times d$ $= 40 \times 40$ $= 1600 \text{ Ncm}$	[1]
3(c)	$(110 \times 80) + 1600 = 75 \times d$ [1] [1/2] [1]	
	$8800 + 1600 = 75d$ $d = 138.67$ $= 140 \text{ cm (2sf)}$ [1/2]	

3(d)	Perpendicular distance between pivot and 40 N force increases Larger CW moment Larger ACW moment needed to balance. Tension in string larger.	 [1/2] [1/2] [1]
4(a)	Rate of change of displacement	[1]
4(b)	AB: Stationary BC: Speed increases at a uniform rate CD: Constant speed DE: Uniform deceleration	[1/2] [1/2] [1/2] [1/2]
4(c)	Similar: Speed increases at a uniform rate Different: The motion in FG is in opposite direction to BC.	[1] [1]
5(a)	At $t = 4$ s, resistive force = 1000 N $F = ma$ $1500 - 1000 = 1800 a$ $a = 0.28 \text{ m/s}^2$	[1] [1/2] [1/2]
5(b)	Forward driving force is constant but <u>total resistive force increases as speed increases.</u> <u>Resultant force decreases.</u> Since <u>$F = ma$</u> , when F decreases, m is constant, a decreases.	[1/2] [1/2] [1/2] [1/2]
5(c)	Car is moving at uniform velocity.	[1]
6(a)	(i) Visible light (ii) Radio waves (iii) Gamma / Ultraviolet (iv) Microwaves	[1/2] [1/2] [1/2] [1/2]
6(b)	Radio – transverse, Sound – longitudinal or Radio – travel in vacuum, sound – cannot travel in vacuum	[1] [1]
7(a)	(i) 0.55 m (ii) $\lambda = 0.80 \text{ m}$ Speed = wavelength / period $2 = 0.80 / T$ $T = 0.40 \text{ s}$	[1] [1] [1]
7(b)	$\lambda = \text{_____ cm}$	[1]
8(a)	Ray through optical centre goes straight through without bending Ray // to principal axis passes through F Ray meets at image position	[1/2] [1] [1/2]
8(b)	Real, inverted, magnified	[1]

8(c)	Image becomes smaller and is formed closer to the lens.	[1] [1]																
9	The negative charges near the top of metal rod are repelled to the bottom since like charges repel. Since metal foil and lower part of metal rod have negative charges, like charges repel and so they move away from each other.	[1/2] [1/2] [1/2] [1/2]																
10(a)	1.2 Ω	[1]																
10(b)	6.0 V																	
10(c)	Current in circuit = 2 + 3 = 5.0 A V = IR = 5.0 x (4.0) = 20 V 20 + 6 = 26 V	[1] [1] [1]																
10(d)	Electrical energy to thermal energy	[1]																
11(a)(i)	At t = 27 min	[1]																
11a)(ii)	Jess. The area under the graph represents the distance travelled. The area under the graph for Jess is larger.	[1] [1/2] [1/2]																
11(a)(iii)	60 x 300 = 18 000 m	[1]																
11(a)(iv)	<table border="1"><thead><tr><th>time / min</th><th>distance / m</th></tr></thead><tbody><tr><td>0</td><td>0</td></tr><tr><td>10</td><td>2 500</td></tr><tr><td>20</td><td>5 000</td></tr><tr><td>30</td><td>7 850</td></tr><tr><td>40</td><td>11 400</td></tr><tr><td>50</td><td>15 650</td></tr><tr><td>60</td><td>20 600 [2]</td></tr></tbody></table>	time / min	distance / m	0	0	10	2 500	20	5 000	30	7 850	40	11 400	50	15 650	60	20 600 [2]	
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11(b)(i)	Correct plot at (60, 20 600) Smooth curve	[1] [1]																
11(b)(ii)	Correct graph (straight line between origin and (60, 18 000))	[1]																
11(b)(iii)	Time at point of intersection of graphs	[1]																
12(a)(i)	The metal particles in the cup near the hot water gain heat and vibrate faster. They knock into adjacent particles and transfer energy to the adjacent particles. In this way, the metal particles near the chocolate milk become hot by conduction Since the cup is made of metal, the energy is also transferred through the metal cup by free electron diffusion.	[1/2] [1/2] [1/2] [1/2]																
12(a)(ii)	Colour: Black Texture: Rough Rough black surfaces are good absorbers of radiation. They will increase the rate of heat gain by radiation.	[1/2] [1/2] [1]																

12(b)(i)	Slide past one another throughout the liquid	[1]
12(b)(ii)	solid	[1/2]
	solid	[1/2]
12(b)(iii)	79°C	[1]
12(b)(iv)	iPE decreases bonds strengthen iKE constant temperature constant	[1/2] [1/2] [1/2] [1/2]
12(b)(v)	Reached thermal equilibrium with the surroundings	[1]
13(a)(i)	$i = 50^\circ$ formula $r = 28^\circ$	[1] [1]
13(a)(ii)	 Bend towards the normal	[1]
13(b)	$\sin c = 1/1.63$ $c = 37.8^\circ$	[1]
13(c)(i)	Total internal reflection	[1]
13(c)(ii)	Higher refractive index, smaller critical angle (smaller than 42°) $i > c$	[1] [1]
13(d)(i)	Image distance = object distance	[1]
13(d)(ii)	Ray from object to mirror Mirror to eye Arrows Dotted lines	[1/2] [1/2] [1/2] [1/2]

