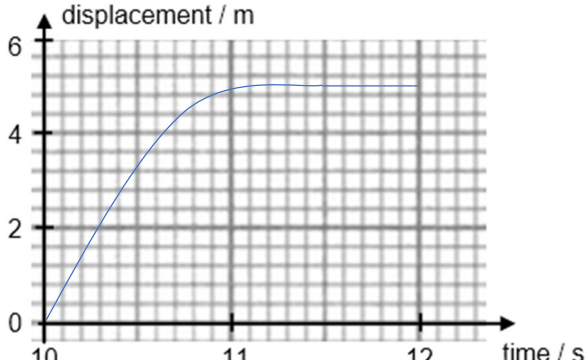


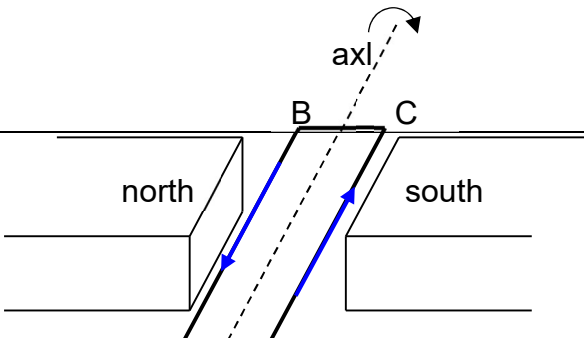
2024 4E Physics Prelim Answers
Paper 1

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

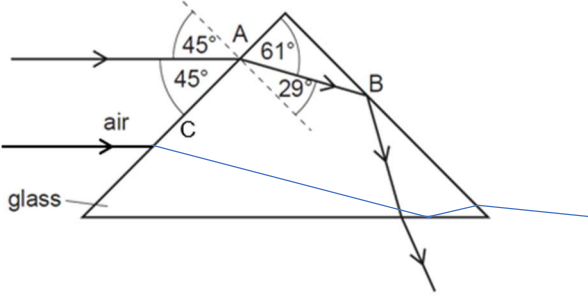
Paper 2

1ai	Fill the measuring cylinder with 50cm ³ of water. Fully submerge the rock into the measuring cylinder. [1] The difference in reading is the volume of rock Q. [1]	
1aii	The volume is large and rock R may not be able to fit into the measuring cylinder. [1]	
1b	Rock S. the density of S is 5.6g/cm ³ while P, Q and R is approximately 4.6 g/cm ³ . [1]	
2ai	Resultant force is zero.	
2aii	The object must move a distance.	
2aiii	Constant velocity	
2b	$F = ma$ $100 - 85 = 25a$ $a = 0.6 \text{ m/s}^2$	
2c	The friction may not be constant. [1] Hence, the resultant force will change [1] and acceleration is not constant.	
2d	 [1] – curve of decreasing gradient from 10 – 11.5s [1] – constant line from 11.5-12s	
3a	Density of the ladder is not uniform.	
3b	Moment = $fd = 8 \times 10 \times 0.90$ [1] = 72 Nm clockwise [1]	

3c	Taking moments about pivot, Sum of clockwise moments = sum of anticlockwise moments $8 \times 10 \times 0.90 + L \times 0.54 = 87 \times 1.3$ $L = 76.1 \text{ N (upwards)}$	
4a	$KE = \frac{1}{2} mv^2 = \frac{1}{2} (0.400)(2.5)^2 = 1.25 \text{ J}$	
4bi	work done = area under the graph $1.25 = \frac{1}{2} \times PQ \times 14$ $PQ = 0.18 \text{ m}$	
4bii	smooth curve from $v = 2.5$ at $x = 0$ to $v = 0$ at Q curve with increasing gradient	
5ai	energy transmitted by electromagnetic waves / infra-red rays infra-red or visible $< \lambda <$ microwaves (scores 2/2 if mentioned infrared in at least one)	
5aii1	air is a poor conductor	
5aii2	convection not the process as convection current occurs (primarily) upwards / hot air rises	
5bi	$Pt = mlv$ $120 \times 1 = 0.05 \times lv$ $lv = 2400 \text{ J/g (or } 2.4 \times 10^6 \text{ J/kg)}$	
5bii	work/energy is required to overcome the forces of attraction / to break the bonds of the water molecules kinetic energy / speed of the water molecules does not increase / is constant	
6ai	compressions and/or rarefactions are closer together OR more compressions and/or rarefactions	
6aii	layers closer together at compressions layers farther apart at rarefactions	
6bi	there is always a time difference / time difference is not zero	
6bii	$v = d / t$ $= 1200 / 3.6$ $= 333 \text{ m/s}$	
7a	distance between the optical centre and principal focus / focal point	
7bi	1. straight line ray from A to B AND lens at intersection of ray and axis. Include label L. 2. ray from A parallel to principal axis, bent at lens to pass through B. F at intersection of ray and axis. Include label F. 3. any third ray from A to B AND bent at lens.	
7bii	1. reduced / decreases 2. diminished / smaller	
8a	The cloth transfers its electrons to the plastic rod during the rubbing process. Hence the plastic rod becomes negatively charged.	

8b	When the metal rod is held above the plastic rod, the negative charges in the plastic rod will repel the electrons in the metal rod. These electrons will flow from the metal rod to the earth through the hand, leaving behind the positive charges in the metal rod. Therefore the metal rod will become positively charged.	
8c	Attractive forces between the negatively charged plastic rod and the positively charged metal rod will result in an upward force exerted on the plastic rod. Hence the reading on the balance will decrease.	
9ai	Resistance = $95\ \Omega$ Accept resistance between $95\ \Omega$ and $97\ \Omega$.	
9aii	Current = $20 / (95 + 50)$ = $0.138\ \text{A}$	
9b	$\frac{50}{50 + R} \times 20 = 5$ $R = 150\ \Omega$ From Fig. 9.2, when resistance of thermistor is $150\ \Omega$, its temperature is $13\ ^\circ\text{C}$. Hence temperature range is $13\ ^\circ\text{C}$ and above.	
9c	The alarm bell will be triggered at a temperature range greater or equal to $31\ ^\circ\text{C}$. Accept minimum temperature between $30\ ^\circ\text{C}$ and $31\ ^\circ\text{C}$.	
10a		

10b	The function of the split-ring commutator is to reverse the direction of the current along side AB every half a revolution. This occurs whenever the commutator changes contact from one brush to the other. The force acting on AB will change to downwards, and this ensures that the coil will always turn in one direction.	
10c	As the coil turns, the moment decreases from its maximum value to zero. This is because of a decrease in the perpendicular distance from the axle to the line of action of the force.	
11a	turns ratio of transformer $K = 12 / 24 = 0.5$ primary coil turns = 375 secondary coil turns = 750	
11b	Laminated soft iron [1] Because iron gains and loses magnetism easily and the laminated core reduces the loss of power. [1]	
11ci	$I = V/R$ $= 24/40$ [1] $= 0.60$ A [1]	
11cii	power loss $= I^2R = 0.60^2 \times 40$ [1] = 14.4 W	
12a	$Z = 89$, $A = 225$	
12b	$\frac{1}{4} = (1/2)(1/2) = (1/2)^2$ Hence, 2 half-lives or $2 \times 15 = 30$ days are required.	
13Eai	$n = \sin i / \sin r = 1 / \sin C$ $\sin C = \sin r / \sin i = \sin 29 / \sin 45$ $C = 43.3$	
13Eaii	$i = 90 - 29 = 61$ [1] since angle of incidence is larger than critical angle, [1] and light travels from an optically	

	denser medium to a less dense medium, total internal reflection occurs. [1]	
13Eaiii	 [1] – light ray parallel to AB [1] – light emerges out of prism as shown	
13Ebi	UV can cause skin cancer if it's over-exposed.	
13Ebii	$v = f \lambda$ $3.0 \times 10^8 = f(400 \times 10^{-9})$ $f = 7.5 \times 10^{14} \text{ Hz}$	
13Ebiii	X-ray and gamma rays	
13Oai	$V = IR = 2 \times 9 = 18\text{V}$	
13Oaii	$V_3 = 22 - 18 = 4\text{V}$ $I = V/R = 4/3 = 1.3 \text{ A}$	
13Oaiii	$I = 2 - 1.3 = 0.7 \text{ A}$ $R = V / I = 4/0.7 = 5.7 \Omega$	
13Oaiv	Overall resistance will decrease. Current through the bulb will increase (0.7A to 1.5A). Brightness increase.	
13Obi	$1 \text{ year} = 365 \text{ days} = 365 \times 24 = 8760 \text{ h}$ $\text{Power} = E/t = 508\,000 / 8760 = 58 \text{ W}$	
13Obii	$\text{Difference in cost of usage} = (697 - 549) \times 0.29 \times 8 = \343.36 Fridge D would be cheaper to buy.	