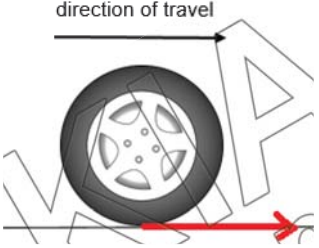
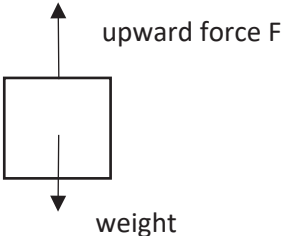


4E5N 2020 Prelim Combined Science (Physics)
Marking Scheme

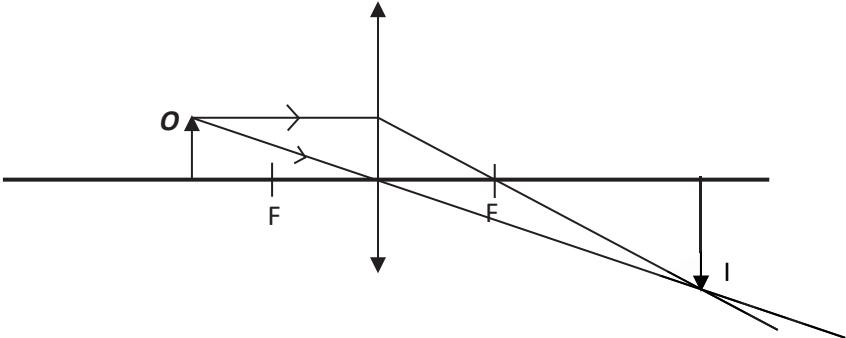
1	2	3	4	5	6	7	8	9	10
D	B	D	A	A	D	C	D	D	C
11	12	13	14	15	16	17	18	19	20
B	A	C	D	C	B	B	C	A	D

Section A

1a	From 0 to 2s, car has zero speed/not moving/stationary. From 2 to 16s, the car has constant acceleration.	1 1
1b	Distance = $\frac{1}{2} \times (8+22) \times 50$ = 750 m	1 1
1ci	0 N	1
1cii	acceleration = $(50 - 0) / 14$ = 3.571 m/s^2 F = ma = 1500×3.571 = 5356 N = 5360 N	1 1 1
1d		1
2a	The principle of moments state that when a body is in equilibrium, the sum of clockwise moment about a pivot is equal to the sum of anticlockwise moment about the same pivot.	1
2b	Using principle of moments, Clockwise moment = anti clockwise moment $600 \times 1.4 = F \times 0.50$ F = 1680 N	1 1
2c	$1680 + 600$ = 2280 N (allow ecf)	1
2d	The gate can be opened by <u>shifting the counterweight further away from the pivot</u> , so that the <u>anti-clockwise moment</u> produced by the force of the counterweight is <u>larger than</u> the <u>clockwise moment</u> produced by the weight of the pole/net anti-clockwise moment.	1 1

3a	$W = mg$ $= (50/1000) \times 10$ $= 0.50 \text{ N}$	1 1
3b		2
3c	$F = ma$ $4.5 - 0.5 = 0.05 \times a$ $a = 80 \text{ m/s}^2$	1 1
3d	$Ht = 0.5 \times 6 \times 60$ $= 180 \text{ m}$	1 1
3e	0 m/s	1
3f	10 m/s ² , downwards	1,1
4a	Boiling, x`	1
4b	Heat supplied is used to <u>overcome intermolecular forces of attraction between the particles</u> of the substance, and to do work against the atmosphere. Internal potential energy increase, but internal kinetic energy remains the same. So temperature of substance remains the same.	1 1
4c	Molecules change from sliding past one another within the liquid to moving freely and rapidly in all direction. They slightly less closely packed compared to solid in a disorderly pattern, to very far apart from one another and randomly arranged.	1 1
5a	There are 50 complete waves produced in a second.	1
5b	16.0 m	1
5c	$v = (1/T)\lambda$ $310 = (1/T) \times 16.0$ $T = 0.05161 \text{ s}$ $= 0.0516 \text{ s}$ (allow ecf)	1 1

5d		1
5e	1 m – frequency, 1 m – amplitude	2
5f	Ultrasound is a longitudinal wave but radio wave is a transverse wave. Ultrasound cannot travel through vacuum, but radio wave can travel through vacuum. <i>Any other possible answers (e.g. speed difference)</i>	1 1
6a	A region in which an electric charge experiences an electric force.	1
6b	Negatively charged particles in the metal strip repel / move away from the sphere. Like charges repel	1 1
6c	1 m – arrowheads, 1 m – electric field lines	2
7a	$n = \sin 50^\circ / \sin 32^\circ$ $= 1.45 \text{ or } 1.4$	1 1
7b	$1.65 = \sin 50^\circ / \sin a^\circ$ $a = 27.7^\circ$	1 1

7c	$n = \text{speed of light in air} / \text{speed of light in liquid L}$ $1.65 = 3.0 \times 10^8 / \text{speed of light in liquid L}$ $\text{speed} = 1.82 \times 10^8 \text{ m/s}$	1 1
7di	 1m – arrowhead, 1m – two light rays 1m – label of I	3
7dii	Virtual image.	1
8ai	$P = V^2/R$ $500 = (240)^2/R$ [1] $R = 115 \Omega$ [1] OR $P = VI$ $500 = 240 I$ $I = 2.0833 \text{ A}$ $R = V/I$ $= 240 \div 2.0833$ [1] $= 115 \Omega$ [1]	2
8aii	$E = Pt$ $= 0.5 \times 8$ $= 4.0 \text{ kWh}$ $\text{Cost} = 4.0 \times 0.23$ $= \$0.92$	1 1
8b	Switch is always connected to the <u>live wire (wire A)</u> , so that appliance is <u>disconnected from high voltage supply when switch is off.</u>	1 1
8c	It is to prevent excessive flow of current into the appliance. / To disconnect the appliance if the current flowing exceeds the fuse rating of the appliance.	1
8d	Wire C / Earth Wire	1

8e	When wire A touches the metal case, the <u>fuse would have blown</u> due to the exceeding current flowing through. OR The <u>leakage current</u> flows <u>to the earth</u> from the metal casing via the earth wire.	1
8f	The appliance is protected with a non-metallic casing.	1
9ai	The particles in water are <u>held closely by strong forces</u> . Hence, water cannot be <u>compressed</u> and thus has a fixed volume. The <u>forces between water particles</u> are relatively weaker than when in solid, allowing them to slide over one another. Hence, water has no fixed shape.	1 1
9aii	Pan B is painted black. Black is a <u>better radiator/emitter of heat</u> than white / Pan B <u>radiates heat at a faster rate</u> than A and so cools faster than A.	1
9aiii	Covering the pans reduces rate of heat loss through <u>convection</u> and/or <u>evaporation</u> . The <u>cooling curves are less steep</u> / <u>final temperature at 8.0 min is higher</u> .	1 1
9bi	When the water around the heating element at the bottom is heated, <u>it expands</u> , <u>becomes less dense and rises</u> . The <u>cold and denser water</u> at the top <u>will sink</u> and get heated up by the heating element. <u>Convection current is set up</u> to heat up the water in the storage tank quickly and hot water will flow out from the top.	1 1 1
9bii	The <u>air</u> in the double-walls is a <u>poor conductor of heat</u> which will reduce heat loss by conduction. The <u>silvery surface</u> of the double walls is a <u>poor emitter / radiator of heat</u> which will reduce heat loss by radiation.	1 1

