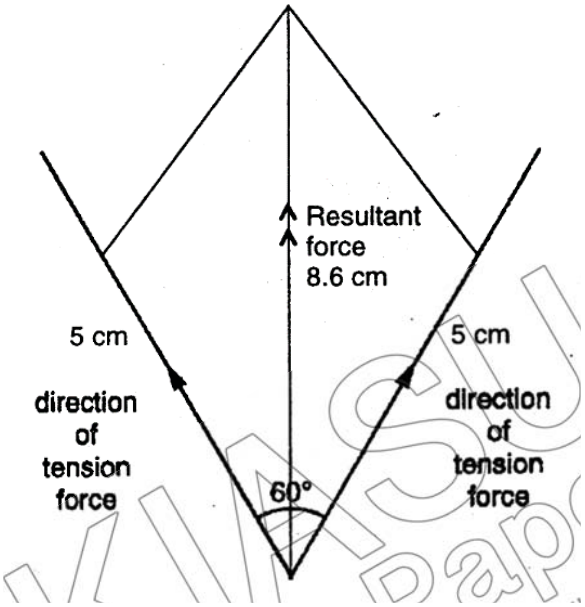
2019 Yuhua 4E/5NA Science Physics Prelimin Paper 1 Answer Scheme

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

2019 Yuhua 4E/5NA Science Physics Prelimin Paper 2 Answer Scheme

1	 Construction of parallelogram [1] Resultant force = 34.4 N [1] Direction of resultant force correctly indicated [1]

2	(a)	The distance from the nail to the pivot is nearer than the distance from the handle to the pivot. [1] By principle of moment, a small force exerted at the handle will create a larger force at the nail. [1]
	(b)	By principle of moments Total clockwise moment = total anti-clockwise moment 6 N x 0.2 m = f x 0.05 m [1] F = 24 N [1]

3	(a)	Ep = mgh = 1 x 10 x 0.1 = 1 J [2]
	(b)	Gain in K.E = Loss in G.P.E = 1 J [1] $1 = ½ mv^2$ $2 = v^2$, v = 1.414 = **1.41 m/s** [1]
	(c)	Some of the energy is converted to thermal energy. [1] The remaining of the energy is converted to GPE at B. [1]

4	(a)	This is because cold air in the frozen food storage is denser and will remain at the bottom [1] while hot air in the cooking compartment is less dense and will remain at the top in the cooking compartment / will not sink to the storage space [1]
	(b)	There should be an insulating material between the cooking compartment and storage space. This would reduce thermal energy transfer by conduction. OR The exterior of the cooking compartment should be light-coloured to reduce the loss of thermal energy by radiation.[1]
	(c)	The exterior should be painted in white. [1] The white exterior is a bad absorber, so heat gain from the hot oven is reduced. [1]

5	(a)	Imaginary line joining up points with the same phase of neighbouring transverse waves together. [1]	
	(b)	(i)	0.15 / 5 = 0.03 m [1]
		(ii)	s = D / t = 0.15 /5 = 0.03 m/s [1]
		(iii)	f = v /λ = 0.03 / 0.03 = 1 Hz [1]

6	(a)	Two correct rays [1] Draws correct image from two rays.[1]
	(b)	Real, inverted and magnified [1]
	(c)	Projector or photographer enlarger [1]

7	(a)	Positive charges [1]	
	(b)	As the base of the thunder clouds are filled with negatively charged particles, the electrons / negatively charged particles in the copper strip will move from the tip to earth [1] since like charges repel [1].	
	(c)	(i)	Q = It = 10 000 x 0.0002 = 2 C [1]
		(ii)	W =VQ = 4.0 x 106 x 2 OR 4.0 x 2 [1] = 8.0×10^6 J [1]

8	(a)	Current = 2 + 2 = 4 A [1]
	(b)	Resistance of each lamp = $\frac{12}{2}$ [1] = 6 Ω [1]
	(c)	$\frac{1}{R_{total}} = \frac{1}{6} + \frac{1}{6}$ [1] R_{total} = 3Ω [1]

9	(a)	The earth wire touches the metal plate of the iron. [1]	
	(b)	(i)	use of I = P/V = 1500/240 = 6.25 A [1]
		(ii)	use of E = Pt

			= 1.5 x 10 = 15 kWh [1] use of Cost = E x unit cost = 15 x 15 = 225 ¢ or $2.25 [1] allow e.c.f for cost, if working shown

10	(a)	When the current is switched on, the iron core becomes an electromagnet. By applying the right-hand grip rule, we find that the right side of the iron core becomes the N-pole of the electromagnet. [1] As like poles repel, the permanent magnet moves away from the iron core. [1]
	(b)	When the current is switched on, the iron core still becomes an electromagnet with the right side as the N-pole. Due to the magnetic field created by the electromagnet, the iron rod becomes an induced magnet with the left side of the iron rod becoming an induced S-pole.[1] As unlike poles attract, the iron rod will be attracted to the iron core.[1]

11	(a)		Straight line graph with a positive slope from (0,0) to (20,30).[1] Horizontal graph from (20,30) to (50,30). [1] Straight line graph and going downhill from (50,30) to (60,0). [1]
	(b)		Rate of change of velocity is constant OR Change of velocity per unit time is constant [1]
	(c)	(i)	acceleration = (v-u)/t = (30 ms^{-1} – 0 ms^{-1}) /20s [1] = 1.5 ms^{-2} [1]
		(ii)	Area under speed-time graph = total distance = ½ (30 + 60)(30) m [1] = 1350 m (allow e.c.f if wrong graph is plotted) [1]
	(d)		Train has higher inertia due to larger mass. [1] Braking distance of train increases. [1]

12	(a)	(i)	n = sin i / sin r
			= sin 20 / sin 13 [1]
			= 1.52 [1]
		(ii)	n = sin i / sin r
			1.52 = sin 35 / sin X [1]
			X = 22.2˚ [1]
		(iii)	n = 1 / sin c
			c = $\sin^{-1}$ (1 / 1.52) [1]
			c = 41.1˚
		(iv)	light makes an incidence angle greater than the critical angle in the optically denser medium [1] Light undergoes total internal reflection where angle of incidence is equal to the angle of reflection [1]
	(b)		Rays 2 and 3 bend away from the normal as they pass from glass into air. Rays 2 and 3 travel in air (optically less dense medium) faster thus they bend away from the normal. [1] Ray 1 does not bend because its angle of incidence is zero.[1]

13	(a)	(i)	1m for flat part of curve at 52°C 1m for flat part of curve at 25°C Minus one mark if there is any point that is incorrectly plotted.
		(ii)	At 60°C, solidification occurs. There is no change in temperature as the energy released is used to form/strengthen the intermolecular bonds.[1] The temperature of the substance does not go below 30°C, as it has reached thermal equilibrium with the room.[1]
		(iii)	The particles are initially slipping and sliding over each other and then starts to vibrate about a fixed position.[1] The arrangement of the particles are initially disorderly, and then become in an orderly arrangement.[1]
		(iv)	Thermal / Kinetic / Internal energy [1]
	(b)	(i)	Evaporation [1]
		(ii)	The temperature decreases as a result of evaporation, as the more energetic molecules escape, leaving the less energetic molecules behind.[1]
		(iii)	Rate of evaporation increases. There are more particles with sufficient energy to escape the surface of the liquid.[1]