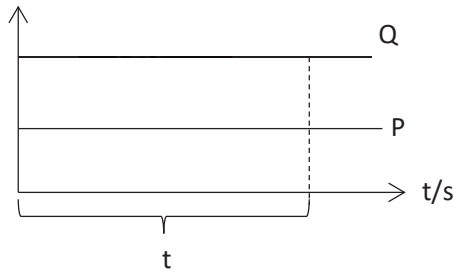
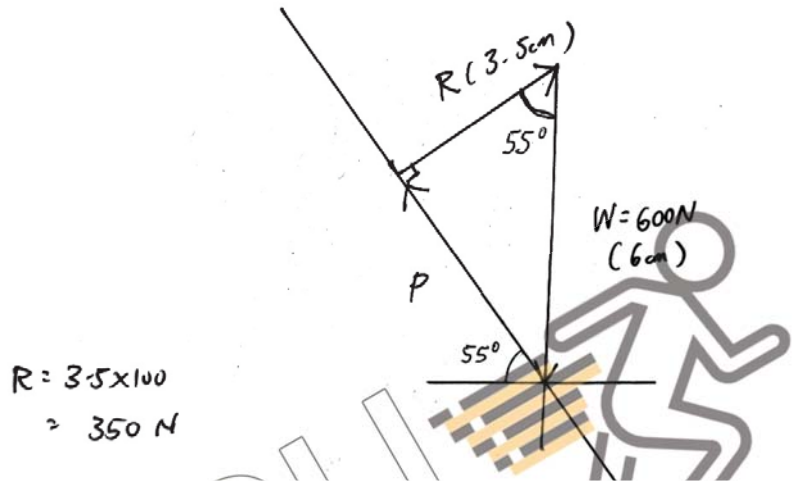
Marking Scheme for 2020 CCHY Prelim Exam Pure Physics

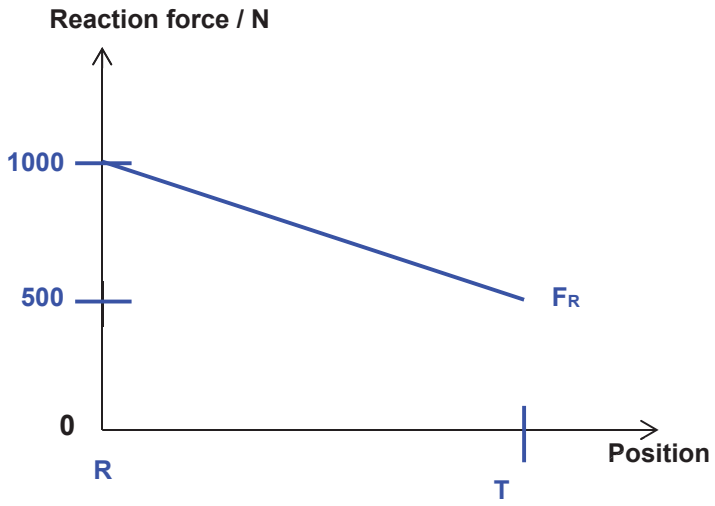
Paper 1

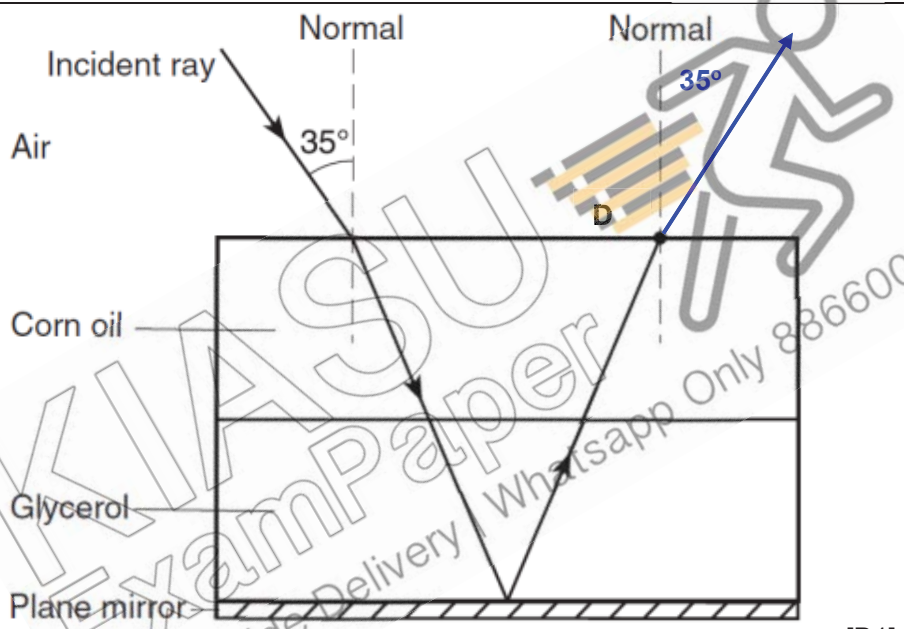
1 B	11 A	21 C	31 A
2 A	12 D	22 D	32 D
3 B	13 C	23 A	33 A
4 D	14 A	24 B	34 B
5 C	15 B	25 C	35 A
6 D	16 C	26 C	36 B
7 B	17 B	27 B	37 C
8 B	18 A	28 B	38 A
9 C	19 C	29 B	39 B
10 D	20 D	30 D	40 C

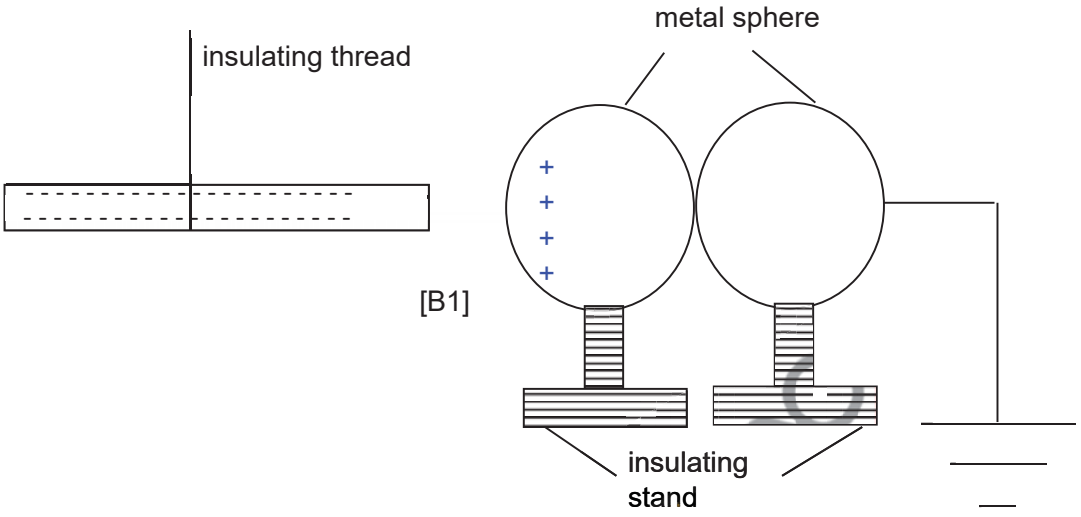
Paper 2 (Section A)

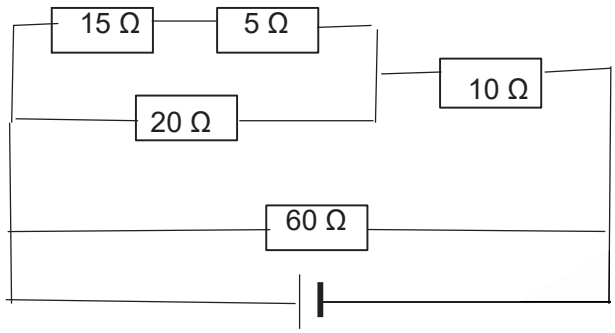
1a	100 km/h = 100 x 1000 / (60 x 60) = 27.8 m/s 30 m/s exceeded speed limit of 27.8 m/s (108 km/h exceed speed limit of 100 km/h)
1b	a = (v – u)/t = (24 – 20) / 12 = 0.333 m/s^2
1c	Distance = distance travelled by P – distance travelled by Q = ½ (20+24) (12) – ½ (30)(12) = 264 – 180 = 84 m
1d	 For Q to pass P, Q must travel 84 m more than P. Distance travelled by Q – Distance travelled by P = 84 m 30t – 24t = 84 6t = 84 [M1] t = 14 s time = 14 + 12 = 26 s [A1]

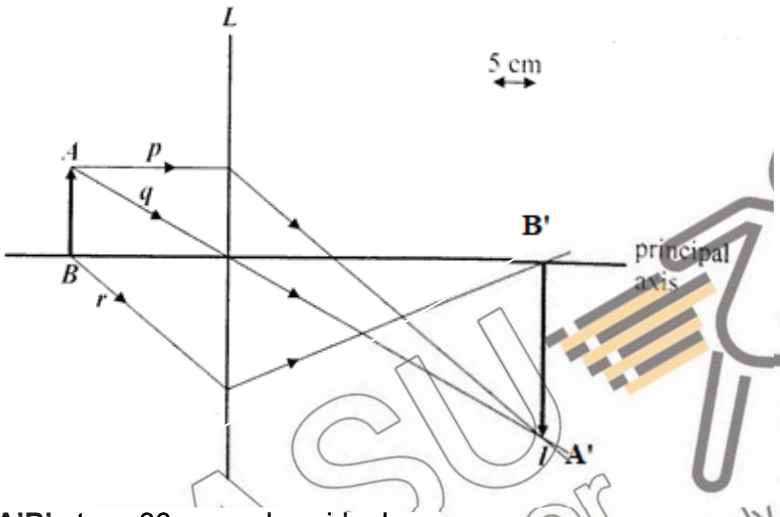
2a	R is 35° to horizontal and resultant force drawn perpendicular to P. [B1] Parallelogram/Triangular/Tip to Tail Law correctly applied [B1] R = 340 N (±17 N, **323 N to 357 N**) [B1] Deduct 1 m for missing labels or arrows on forces or inappropriate scale (at least 1 cm : 10 N) 
2b	There is no resultant force [B1] acting on the boy and sledge hence there is no acceleration and moves at constant speed [B1].
3a	Taking moments about R, Sum of clockwise moments = Sum of anticlockwise moments (1000)(1.5) + 500(2.0) = F_T(3.0) F_T = 833 N upwards
3b	Sum of upward forces = sum of downward forces $F_R + F_T$ = 1000 + 500 F_R + 833 = 1500 F_R = 667 N upwards

3c	 1 mark for linear line. 1 mark for correct labelling
4a	$v = \frac{\lambda}{T}$ $5 = \frac{2}{T}$ [M1] T = 0.40 s [A1]
4b	0.1 s = (0.10 / 0.40) T = 0.25 T [M1] 0.25 period later → particle P would have moved up to max +ve displacement. [A1]
5a	CM = ACM F x 10 = 250 x 30 [M1] F = 750 N [A1]
5b	P = F / A = 750 / 1.5 [M1] = 500 N/cm^2 [A1]
5c	F = P A = 500 x 5 [M1] = 2500 N [A1]
6a	P(gas) = P(Hg) + P(atm) = hpg + 103000 = (13600 x 0.2 x 10) + 103000 [M1] = 130 kPa [A1]
6b	It will remain the same. [B1] Because the gas pressure and atmospheric pressure remain unchanged. [B1]

6c	Number of particles per unit volume increases [B1]. Greater frequency of collision by the molecules against the wall [B1]. Greater force on the wall and greater pressure as P = F / A [B1].
6d	The pressure of the gas will increase [B1]. Gas molecules gain kinetic energy, average speed molecules increase [B1]. Greater frequency of collision and greater collision force by the molecules on the wall. Greater force on the wall thus greater pressure of the gas as P = F/A [B1].
7a	sin i / sin r = n Sin 35 / sin r = 1.47 r = 23.0°
7b	Both liquid have the same refractive index [B1].
7c	 [B1]
7d	No [B1]. As x increases the angle of incidence at D can never be more than the critical angle of corn oil [B1].
8a	The negative charged electrons in the sphere is repelled by the negative charged rod to the right . Excess positive charge on the left side of sphere and excess negative charge on the right side of sphere (Minus 1 mark if students write positve charges are attracted by the rod and/or positive charges move to the left.) Must conclude that the left side of sphere has net positive charge to score full marks.

8b	 [B1] The negative charged electrons in the spheres are repelled to the extreme right side of metal sphere connected to earth]. Earthing will occur and the excess electrons flow to the ground (minus 1 mark if students write positive charges are attracted and/or moved to the right) (will only score at most 1 mark if the charge distribution is drawn wrongly)
	SECTION B
9ai	The particles vibrate/are displaced parallel to the direction of the wave motion [B1]. (particles move left and right, particles move parallel to wave motion will not be accepted)
9aii	Amplitude = 0.7 cm to 0.9 cm Wavelength = 12.8 cm to 13.0 cm
9aiii	t= d/v = (6.45/100) / 1500 = (4.2 to 4.4) x 10^{-5} s
9bi	The air in A is free to move while air is trapped in B. This minimises conduction in B as **trapped air is a bad conductor of heat**. **Convection** is harder to take place in B due to the trapped air and hence there is less heat loss in B
9bii	B (can only score this mark if reason is correct) The closely packed leaves in C have **less trapped air** than the loosely packed leaves in B. Hence, **conduction to take place more easily** in C

9biii	Silver as it is a poor radiator/emitter of heat (No mark if students mention silver is a bad emitter and absorber of heat or a good reflector of heat.)
10a	15 and 5 ohm resistors drawn in parallel to 20 ohm resistor [B1] Whole circuit correct – 2m 
10b	Total effective resistance = 1/ (1/60 + 1/20) = 15 Ω (allow ecf of 1 mark if total Resistance is computed correctly according to circuit drawn) (no mark given if 10a is correct but the total resistance is not equal to 15 ohm)
10c	Effective resistance of 15 Ω, 5 Ω, 10 Ω and 20 Ω = 20 Ω Total current in circuit = 12/15 = 0.80 A Current passing through 60 ohm resistor = 12/60 = 0.20 A Current flowing through 10 Ω resistor = 0.80 – 0.20 = 0.60 A Current flowing through 20 ohm resistor = 0.60/2 = 0.30 A - 2sf
10d	Total current in circuit = 12/total resistance = 0.80 A (allow ecf from wrong total resistance of 10b) penalize sf , eg 0.8 A
10e	Energy consumed = Pt = IVt = (0.8 x 12) / 1000 x 12 = 0.115 kWh Ecf full marks (ie 2 marks) if students compute kWh value correctly based on wrong total current in 10d. Ecf 1 mark if students did not express power in kW or they express time in second (rather than hour) (minus 1 mark if student express energy in J and not in kWh, as required by question)

11	**Either**
a	$1/R_{eff} = 1/R_1 + 1/R_2 = 1/(30+30) + 1/(40+20) = 2/60 = 1/30$ $R_{eff} = 30\ \Omega$
b	$I_{batt} = V_{batt} / R_{eff} = 12 / 30 = 0.40$ A – 2sf
c	$V_{AX} : V_{XC} = 6 : 6 \rightarrow$ abs potential at X is 6 V $V_{BY} : V_{YD} = 8 : 4 \rightarrow$ abs potential at Y is 4 V $V_{XY} = 6 - 4 = 2.0$ V – 2sf
d(i)	 **A'B'** at v = 36 cm and upside down Two complete paths of **p**, **q** Complete path of **r** (no arrow heads minus 1 mark)
(ii)	Focal length = 12 cm (accept 11.5 cm to 12.5 cm)
(iii)	Image becomes larger
	OR
a	current = p.d. / total resistance = 12 / (0.30 + 4.5) = 2.5 A
b	**Decrease resistance** of the variable resistor so as **to reduce the current**. [B1] – must mention to reduce the current not just decrease the resistance. Increase the power supply or battery emf alone is not accepted. Increase the number of turns per unit length of solenoid.] – increase number of coils not accepted as the solenoid has only 1 coil of wire.
ci	X: South pole, Y: North pole
cii	The magnetic field from the electromagnet interacts with the magnetic field due to the current in PQ resulting in a net force exerted on PQ.

	This net force causes PQ to move out of the page / outwards/ towards observer.
ciii	PQ/ wire alternates between out of page and in of page / outwards and inwards Due to ac in solenoid, the magnetic field alternates (vertically) downwards and upwards OR magnetic poles produced at X and Y alternates producing alternate inward and outward forces on wire PQ
civ	Steel is a hard magnetic material and will retain the magnetism even after the current is switched off. So it cannot be used as the core of an electromagnet as it is a temporary magnet.