Zhonghua Sec School

Answer Scheme

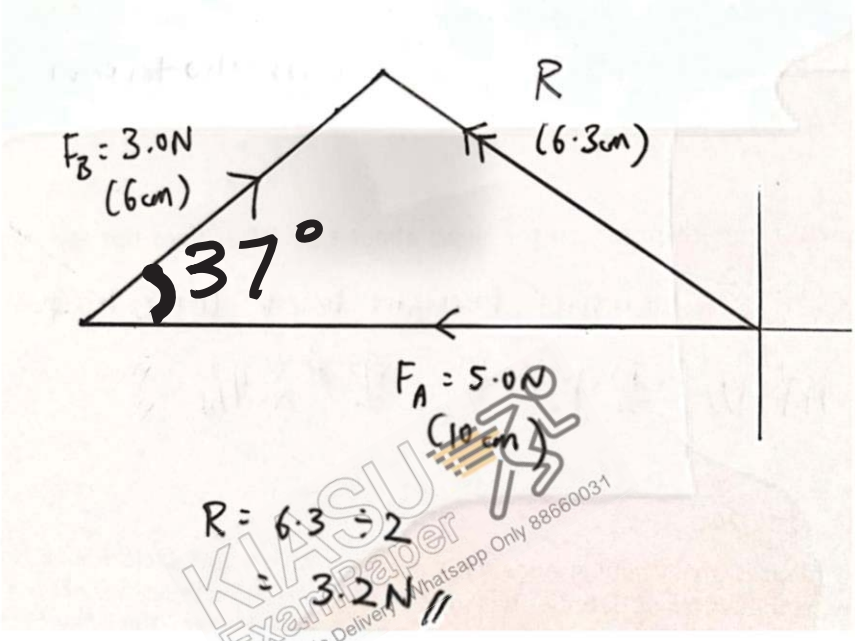
Physics (6091) Prelim 2020

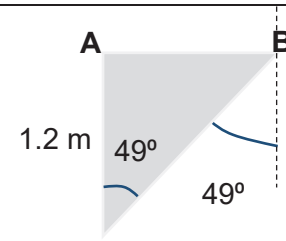
Paper 1

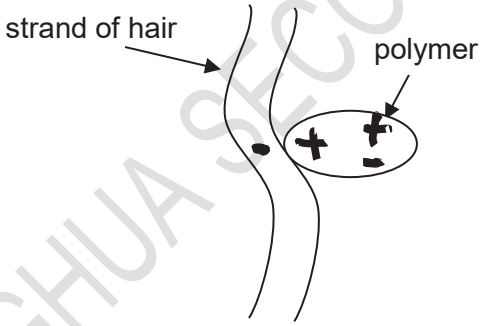
Prelim Paper 1 MCQ Solutions 2020							
1	C	**11**	B	**21**	B	**31**	D
2	A	**12**	C	**22**	D	**32**	D
3	C	**13**	A	**23**	A	**33**	B
4	B	**14**	A	**24**	D	**34**	A
5	B	**15**	A	**25**	C	**35**	C
6	B	**16**	B	**26**	C	**36**	A
7	A	**17**	C	**27**	A	**37**	A
8	C	**18**	C	**28**	B	**38**	D
9	A	**19**	D	**29**	B	**39**	D
10	A	**20**	C	**30**	C	**40**	A

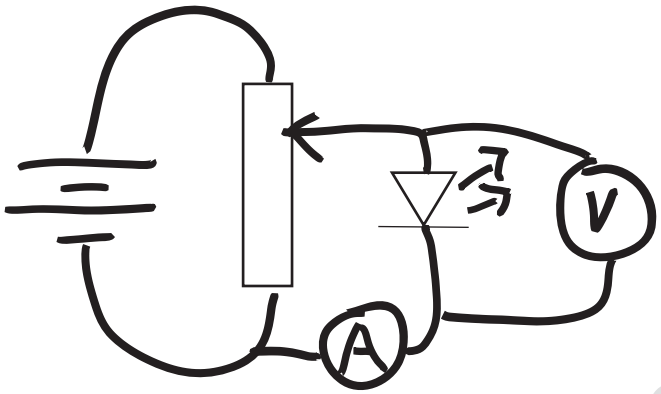
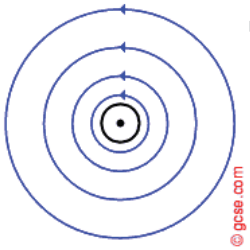
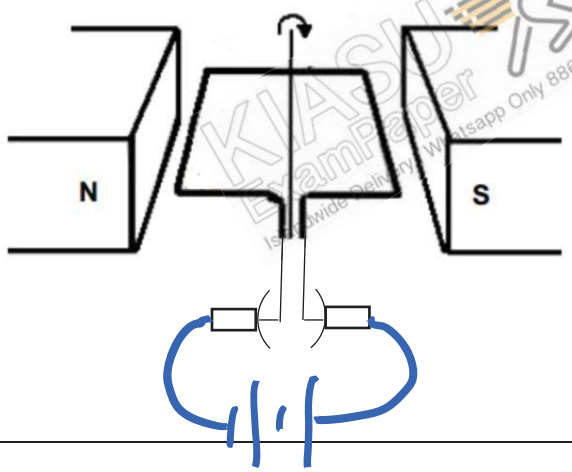
Paper 2

Section A

Question	Answer	Marks
1	Scale: 1cm: 0.5 N  	1 – electric forces direction 1 – arrow + scale 1 – label (includes angle and forces) 1 - ans
2(a)	R_1 passes through with no bending R_2 exits, bends away from normal R_3 skims surface R_4 undergoes total internal reflection	2 rays to get 1 m All to get 2 m

2(b)	n = 1 /sin c = 1 / sin49º = 1.33 1.33 = sin r/sin20º r =26.9 º	 1 1
2(c)	 tan49º = AB/1.2 AB = 1.2 tan49º = 1.38	1
3(a)	3 correct rays	1 m for any correct set of i, r or v rays
3(b)	Label f with indication of length	1
3(c)	Upright, magnified, same side of lens as object (any 2)	1
4(a)	Mass = volume x density = $1.3 \times 10^7\ m^3 \times 1000\ kg/m^3$ = 1.3×10^{10} kg	 1
4(b)	Useful output E / Input E = 0.90 KE / GPE = 0.90 $(½\ v^2) / (gh) = 0.90$ $½\ v^2 = 0.90(10)(80)$ v = 37.9 m/s	Mgh term-1 Eqn -1 Ans – 1
4(ci)	W = mgh where h = 10 m = (1)(10)(10) = 100 J	1
4(cii)	Water in the reservoir will flow until the level in pipes is same as reservoir surface. The pump only needs to lift water up by 10 m.	1 1
5(a)	Taking M about X, CWM = ACM $30(80) = F_B\ (10)$ F_B = 240 N	 1
5(b)	F_B is greater than W, so need downward force to balance Hence F_X is downwards	1

	$F_{up} = F_{down}$ $240 = 30 + F_X$ $F_x = 210$ N	 1
5(c)	F_B increases. As F_B tilts, the <u>perpendicular distance decreases</u>. To maintain the <u>same</u> anti-clockwise <u>moment</u> to balance the clockwise moment, (<u>M = F x d</u>), F_B must increase.	1 1
6(a)	Density of B increases $(h\rho g)_{liquid\ A} = (h\rho g)_{liquid\ B}$ larger h_A × smaller ρ_A = smaller h_B × larger ρ_B OR For the same pressure, the smaller the height of the liquid, the larger the density	1
6(b)	more than θ with reference to Fig. 6.2	1
7(a)	• Rigorous combing results in friction between hair and comb, which results in <u>electrons being transferred from comb to the hair or vice versa.</u> • Hair strands carry like charges and like charges repel.	1 1
7(b)		1: charge of hair 1: charge of polymer (<u>must show neutral region</u>)
7(c)	Positive end of cationic polymers are attracted to the hair strands, as unlike charges attract. <u>Hair strands coated with polymer are neutral,</u> and hence hair strands do not repel each other.	1
8(a)	$V_{led} = [R_{led} / (R_{led} + R_{rheostat} + R_{fix\ resistor})] \times emf$ $3.0 = [R_{led} / (R_{led} + 500 + 330)] \times 9.0$ $R_{led} = 415\ \Omega$ (R LED = 3.0 V / current in circuit) – 1 mark	 1 1
8(b)	Resistance of rheostat must be increased. $V_{led} = [415 / (415 + R_{rheostat} + 330)] \times emf$ Therefore V_{led} will decrease from 3.0 to 1.7 V	1 1

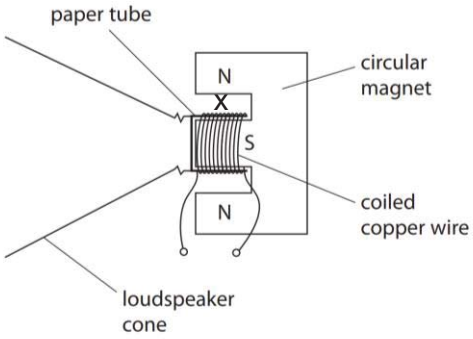
	(state that V is proportional to R. If the resistance of rheostat increases, the voltage will increase too. Since emf = PD of every component, therefore voltage across LED decreases)	
8(c)		1 mark for correct connection of LED and potiometer 2 marks for perfect diagram **A and V in correct position – 1 mark**
9(a)	No because the potential difference across the lamp is not <u>directly proportional</u> to the current through it.	1
9(b)	Current through L = 1.25 A (since L and R has the same potential difference. Current through resistance wire = 2.0 + 1.25 A = 3.25 A Resistance of resistance wire = 6.5 / 3.25 = 2.0 Ω	1 1 1
9(c)	Diameter is doubled implies cross sectional area is increased by a factor of 4 New resistance = 2 / 4 = 0.50 Ω	1
10(a)		1 – dot, direction of B field and multiple B field lines
10(b)		1 – brush and commutator 1 – power supply direction

10(c)(i)	X = Y = Z: South poles	1 – identification of X and Y using RHGR 1 – identification of Z using repulsion principle
10(c)(ii)	The dc supply can be changed to alternating current supply. After half a turn, the X and Z poles will change to north poles and the side magnets will repel the middle magnet and ensure it continues turning CW.	1 1

Paper 2

Section B

Qn	Answer	Marks
11(a)(i)	The television consumes electrical energy of 66 kWh when it is turned on for 5 hours daily, for 365 days. OR Energy consumed in 1 year equals the 66kW appliance being used for an hour	1
11(a)(ii)	66 kWh = power × time 66 000Wh = power × 5 hrs × 365 days power = 36 W	1 1
11(a)(iii)	Annual energy cost = 66 kWh × 27 cents = $17.82	1
11(a)(iv)	The television might not be turned on for 5 hrs, everyday, Or The sound and brightness of the screen might vary.	1
11(b)(i)	height of 39.9 cm and width of 70.9 cm equals height of 3.99 dm and width of 7.09 dm = 28.3 dm^2	1
11(b)(ii)	"0.30 × (20 + 4.3224 × screen area) $\geqslant P >$ 0.16 × (20 + 4.3224 × screen area)" Since 42.7 $\geqslant P >$ 22.8, four ticks is accurate.	1

11(c)	P = VI 50 = 240I I = 0.21 A Fuse rating is unsuitable. Rating should be slightly more than current so that in the event of an electrical fault, it can cut off high voltage supply and appliance is safe to touch. / overheating	 1 1
11(d)	Earth wire is connected to the metal casing of the television Or Switch is located in the live wire. Or Double insulation	1
12(a)	Emf / voltage of power supply changes direction in regular cycles	1
12(b)	Period = 1 / 50 = 0.020 s.	1
12(c)	Current travels to the top of the page	1
12(d)	 At position x: • Using Fleming's LHR, thumb (force), index finger (magnetic field) and middle finger (current) are all perpendicular to one another • Thumb – left of paper, magnetic field – bottom of paper, current – into the paper	 1 1
12(e)	• The direction of current changes and the cone is moves left and right with a period of 0.02 s and vibrates. • The air molecules in front of the cone are being pushed and pulled, setting up regions of compressions and rarefactions (can be drawn) • Wave travels parallel to propagation of energy / longitudinal wave	1 1 1
12(f)	• The current in the wire is increased so that the resultant magnetic force is increased • The amplitude of the sound wave is increased.	1 1
Either		

(a)	For 0.50 s, the object changes (accept increases) its velocity by the same amount.	1
(b)i)	V = 40 cm/ s = 0.40 m/s a = (v – u) / t = (0.40 – 0) / 0.50 = 0.80 m/s^2	 1
(b)ii)	Distance = area under v-t graph = ½ (0.50)(40) + 4.5(40) = 10 + 180 = 190 cm (or 1.90 m)	 1
(c)i)	F by crate on pallet (downwards on pallet) F by crate on earth (upwards on earth)	1 1
(ii)	Resultant force on crate = ma = 200(0.80) = 160 N $F_{\text{by pallet on crate}}$ - W = 160 F – 2000 = 160 F = 2160 N	 1 1 1
(iii)	Work done = weight x d = weight x (speed x time) = 2000 (0.40 x 4.5) = 3600 J Rate of W = 3600 / 4.5 = 800 J/s (or W)	 1 (any Fd) 1
OR		
(a)	3.65 kJ of energy needed to heat 1 kg of apple by 1 K.	2
(b) i)	Q_P= mc $\Delta\theta$ = (4000)(3.65 x 10^3)(25-5) = 2.92 x 10^8 J	 1
(ii)	Q_L = 3 x 5 x 3600 x 100 = 5.4 x 10^6 J or 1500 wH	1

(iii)	Rate of heat = (total heat) / time = (2.92 x 10^{8} + 5.4 x 10^{6}) / (24 x 3600) = 3440 W	1 - (Sum of E)/ time 1 – the rest
(c)	Heat is gained from the surroundings Two workers add heat to the room	1 1
(d)	Cold air <u>sinks as it is denser</u>, allows <u>convection currents</u> to cool whole room.	Sinks alone – 1 Rest - 2nd mark