Anglo-Chinese School (Barker Road)
2020 Sec 4 Physics (6091) Preliminary Examination Marking Scheme

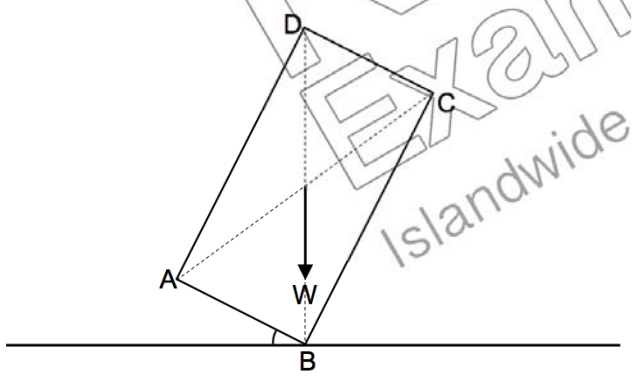
Paper 1

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

Paper 2

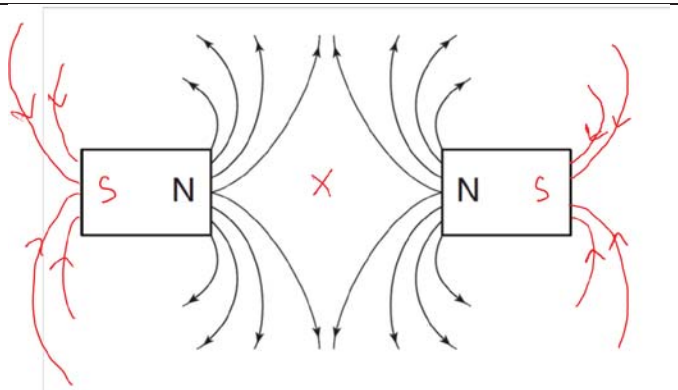
Overall remarks:

- Students who give answers in fractions will get 1 mark deducted off the whole paper.
- 1 mark is deducted for every different incorrect unit.

		Answers	Marks	Examiner's Comments
1	(a)	t = 0.0 s – 10.0 s : Bicycle was travelling with **constant acceleration.** t = 10.0 s – 20.0 s: Bicycle was travelling with **decreasing acceleration.**	A1 A1	
	(b)	(i) F = ma 600 – 20 = (150)(a) a = 3.87 m/s^2	M1 A1	
		(ii) a= (v-u)/t 3.87 = $\frac{V-2}{10}$ v = 40.7 m/s	M1 A1	ECF allowed
2	(a)		A1	As long as the cross is placed somewhat in the centre
	(b)		A1 A1	Arrow to indicate weight and label W (as long as perpendicular down) W arrow to pass through B

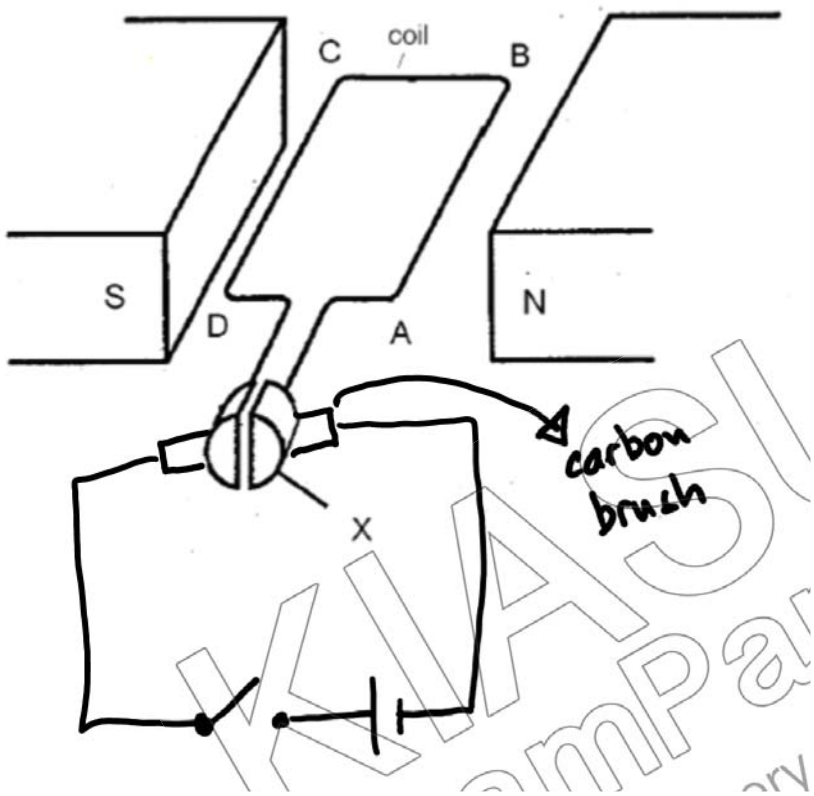
	(c)		The block must **be tilted more** as **the CG is now lowered** and hence the block is more stable	A1	More stable is not a marking point
3	(a)		Pressure due to Hg height difference = hρg = 0.16 x 13600 x 10 = 21 760 Pa Pressure in the flask = 21 760 + 100 000 = 121 760 Pa = 122 000 Pa (3.s.f.)	M1 A1 A1	
	(b)		As it cools, **KE of molecules of air decreases** and **the velocity of the molecule decreases** resulting in molecules hitting the surface of the **flask less frequently and less forcefully.** Since Pressure **is force per unit area, this results in a lower air pressure** in the flask	A1 A1	Velocity is required
4	(a)		**Product of force and distance travelled by object in the direction of the force.**	A1 A1	
	(b)		Energy at B = energy at C $0.5mv^2 + mgh = 0.5mv^2$ $0.5 \times 5^2 + 10 \times 12 = 0.5 \times v^2$ $v = 16.3$ m/s	M1 A1	
	(c)	(i)	Work done = 10 × 10 = 100 J	A1	
		(ii)	Energy of ball at E = Energy of ball at B – Work done agst friction = 265 – 100 = 165 J	A1	
	(d)		**Above AB level, indicated with X**	A1	
5	(a)	(i)	The potential difference measures **the temperature difference between the two junctions** and is not able to tell the temperature of the surrounding air.	A1	Temperature of liquid is unknown is not suitable
		(ii)	5.0 mV -> 100°C 1.2 mV –> 100 x (1.2/5) = 24°C	M1 A1	

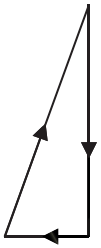
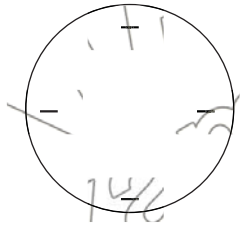
	(b)	The temperature reading after the fault **will be lower than the actual reading / Inaccurate** The **height of the liquid column will not change linearly with temperature** OR **a larger increase in volume** will be required to **produce the same change in height**		M1 A1	
6	(a)	frequency = v / λ $= 3 \times 10^{8} / 720 \times 10^{-9}$ $= 4.17 \times 10^{14}$ Hz		M1 A1	
	(b)	(i)	**Infrared**	A1	
		(ii)	**Cooking, remote control, intruder alarms etc.**	A1	Added intruder alarms
7	(a)	(i)	$sin\ 30 / sin\ i = 1.33$ $i = 22.1°$	M1 A1	
		(ii)	The ray R_2 travels from a **more optically dense medium to a less optically dense** medium, and is incident at the boundary with **an incident angle that is greater than the critical angle of water. Total internal reflection** occurs.	A1 A1	
	(b)	In Fig. 7.2, light is able to be **totally internally reflected and** will light up the whole room while in Fig. 7.3, light enters the house and is only able to light a portion of the room. **Allow explanation to be supported by light rays and TIR must be seen** drawn in Fig. 7.2 and Fig. 7.3 if written explanation is not clear.		A1	
	(c)	The boys feels warm due to **radiation** from the sun. **Only radiation is able to pass through a vacuum**		A1	

8	(a) (i) (ii)	 	B1 B1	
	(b)	**Iron.** It is a **soft magnetic material** and you want a material that is able to **magnetise and demagnetize easily**	B1 B1	Insist on both magnetise and demagnetize easily
9	(a)	Minimum distance $= \frac{330m/s \times 0.0005s}{2}$ $= 0.0825m$	M1 A1	
	(b)	Minimum distance $= \frac{300000000m/s \times 0.0005s}{2}$ $= 75\ 000\ m$ The minimum distance **would increase to 75000 m and the proximity warning will not work in normal parking situation, so the sensor with sound would be better**	A1 A1	No ecf for this? But allow marking for second point

10	(a)	R=V/I = 200/(7.6-1.9) = 35.1 Ω	M1 A1	
	(b)	P=IV = 7.6 x 200 =1520 W Energy = P x t = 1.52kW x [(110/60) x 7] = 19.5 kWh Cost = 19.5 x 0.22 = $4.29	M1 M1 A1	See 7.6 x 200, mark can be given
11	(a)i)	$Q = mc\Delta\theta$ $200 \times 10^6 = m\ (4.2 \times 10^3)\ (45 - 25)$ m = **2380 kg**	M1 A1	
	aii	$Q = mc\Delta\theta$ = 2380 × 4 200 × (45 – 14) = **3.10×10^8 J** or **310 MJ**	M1 A1	Ecf allowed
	aiii	$E = Pt$ $t = \frac{3.10\times10^8}{(12\times10^3)}$ = **25 800 s** or **7.17 h** or **7.18h**	M1 A1	Accept 7.18h Ecf allowed
	(b)	The temperature difference between warm water and outdoor temperature is 31°C for France and 26 °C for Fiji. The **amount of solar energy required to heat up water in Fiji is 0.84 of France.** **Fiji will need (7.17 x 0.84) = 6 hrs** of daily sunshine to gather the amount of solar energy required. However, **Fiji receives only 4 hrs** of daily sunshine and is unable to accumulate enough solar energy to maintain a temperature of 25 °C	B1 B1	No data – 1

	(c)		The water pipes can be made of **metal** as metal is a **good conductor of heat.**	B1 B1	
12	(a)		Ohm's Law states that the **current flowing** through a conductor is **directly proportional to the potential difference**, provided **all physical conditions remain constant.**	B1 B1	
	(b)		As the **current increases**, the **temperature of the wire increase,** which affects the resistance of the circuit.	B1	
	(c)		As **V increases, the gradient decreases** **Gradient = I/V = 1/R. So, R increases.** OR **Ratio of V/I increases.** Since **R=V/I, R increase**	B1 B1	
	(d)	(i)	Component X is a **rheostat or a variable resistor**	M1	
		(ii)	If the resistance of X is higher, **the total resistance in the circuit increases**. Since **voltage of the circuit remains the same, and I=V/R**, the current in the circuit will decrease	B1 B1	OR accept. Increasing R of X will increase V at x, decreasing voltage at lamp. By V=IR, since Voltage decrease, and R remains the same, I will decrease
	(e)	(i)	Electric current = 0.05 A	M1	
		(ii)	I = V / R = 2.5 / 200 = 0.0125 A	 A1	
13 E	(a)		Current flows in **the direction of DCBA/ clockwise around the coil.** The force acting on **DC is acting upwards / AB is acting downwards**. Using your **thumb to represent direction of force**, **index finger to represent direction of magnetic field** and **middle finger to represent the direction of the current.**	B1 B1 B1	

		The **magnetic field is perpendicular to the current** and **the force is perpendicular to both of them**		
	(b)	 **B1 – Correct circuit symbols** **B1 – Correct connection.**	B1 B1	Complete connection to get 1m Correct circuit symbols except for carbon brush 1m
	(c)	**Split Ring Commutator.** It **reverses the direction of the current every half a revolution**. So that the **direction of the force switches direction** when the **coil is in the vertical position**, allowing in to complete a full rotation	B1 B1 B1	
	(d)	**Reverse Direction – Switch direction of cell / Swap the polarity of magnets.**	A1	

			Rotate faster – Increase current in the coil, increase voltage of battery, in soft iron core in the coil, increase strength of permanent magnet		
13 O	(a)	(i)	**Positively charged**	B1	
		(ii)	[1] – Scale **1cm:1N or 2cm:1N** [1] – Arrowhead correct [1] – Correct Diagram [1] – Correct values of weight and repulsion Weight: 4.7 ± 0.3 N Repulsion force: 1.7 ± 0.2 N 	B4	
		(iii)	It is the **gravitational force of the sphere on the earth**		
	(b)	(i)	**Negative charges/electrons** will move from **Earth to the sphere.**	B1	
		(ii)	**Sphere moves towards the charge plate.** **Sphere has a net negative and unlike charges attract**	B1 B1	
		(iii)		A1	