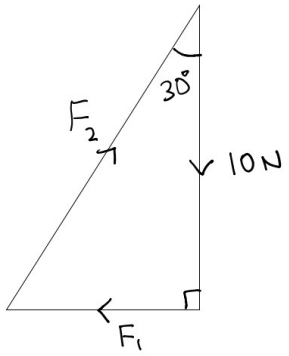
BEDOK GREEN SECONDARY SCHOOL
SCIENCE DEPARTMENT
MARKING SCHEME
YEAR (2024)

SUBJECT: Pure Physics (6091)
EXAM: Prelim
LEVEL: 4E

PAPER 1

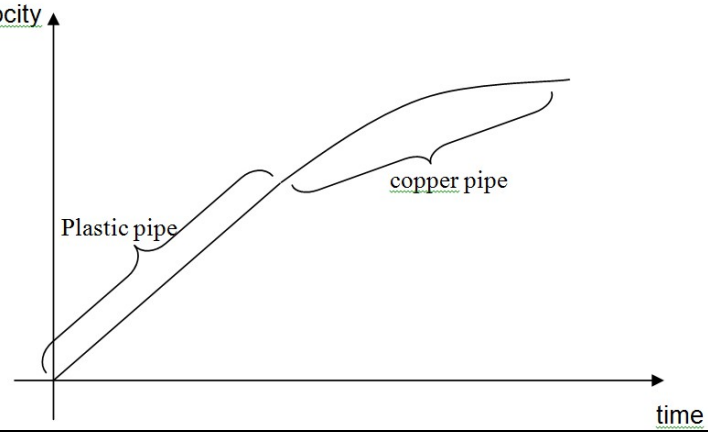
1	C	**11**	C	**21**	C	**31**	D
2	C	**12**	C	**22**	C	**32**	B
3	D	**13**	A	**23**	B	**33**	C
4	D	**14**	C	**24**	D	**34**	C
5	A	**15**	B	**25**	A	**35**	C
6	B	**16**	A	**26**	B	**36**	C
7	C	**17**	B	**27**	C	**37**	C
8	A	**18**	C	**28**	D	**38**	C
9	B	**19**	D	**29**	B	**39**	D
10	A	**20**	C	**30**	B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

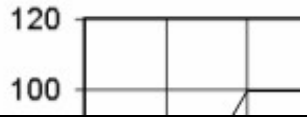
PAPER 2
Section A: 70 marks

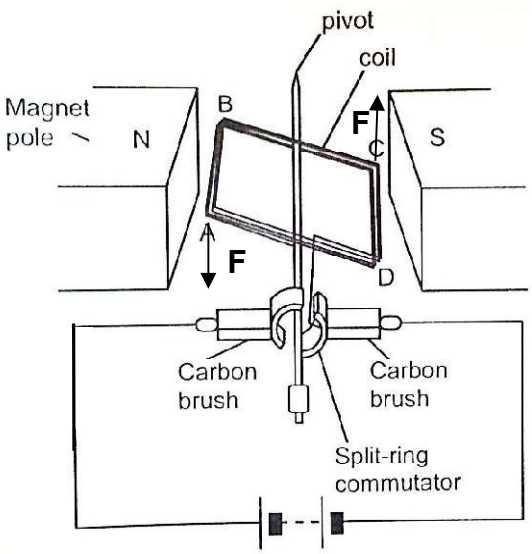
Qn. No.	***Scoring Points***	***Marks***	***Max. Marks***
1	 F_1 = 5.8 N F_2 = 11.5 N	1 m for scaled drawing 1 m for correct vector diagram 1 m each for F_1 and F_2 (within ±5% of ans)	4
2ai	1 sec	**1**	**1**
2aii	a = (v – u) / t = (0 – 10) /4	 1	2

	= - 2.5 m/s^2 Deceleration = 2.5 m/s^2	 1	
2bi	Car B travelled a longer distance. Distance = area under speed time graph. The area under graph of Car B is larger than that of Car A, hence Car B travelled a longer distance.	1 1	2
2bii	The graph of Car B shows the car experiencing an increasing deceleration. As braking force = ma, hence the car is exerting an increasing braking force to stop the car.	 1 1	2
3a	When the piston is pushed into the cylinder, the volume of gas decreases. This causes an increase in the frequency of collision between the gas molecules and the walls of the cylinder, causing pressure to increase.	1 1	2
3b	When temperature of the cylinder increases, the gas molecules gain speed and energy. This causes the force exerted by the gas molecules on the walls of the cylinder per unit area as well as the frequency of collision between the gas molecules and walls of cylinder to increase. Gas pressure increases, causing the piston to be pushed out.	 1 1	2
4a	As the pulse travels through the sea and reflects upon hitting the underwater object, it loses energy, reducing its loudness. Since the amplitude shows the loudness of the pulse, the amplitude of the reflected pulse is smaller than the original pulse.	 1 1	2
4bi	Time taken = (50 ms x 8) / 2 = 200 ms	 1	1
4bii	Distance = 1500 x (200 x 10^{-3}) = 300 m	1 1	2
5a	$n = \frac{c}{v}$ $1.8 = \frac{3 \times 10^8}{v}$ $v = 1.67 \times 10^8 m/s$	 1 1	2

5b	$n = \frac{1}{\sin c}$ $c = \sin^{-1}\left(\frac{1}{1.8}\right)$ $c = 33.7°$	1 1	2
5c	When the ray of light hits side A and B, it will undergo total internal reflection for both sides. This is because the angle of incidence in the denser medium (glass) on both sides is larger than critical angle.	1 1	2
6a	The thermistor is initially cold and has high resistance and the p.d. across the lamp is small. When the thermistor is heated up, its resistance drops and the p.d. across the lamp increases, lighting it up.	**1** **1**	**2**
6b	$V_{lamp} = \frac{13.6}{1000} \times 10 = 0.136V$ $V_{thermistor} = 1.5 - 0.136 = 1.364V$ $R_{thermistor} = \frac{V_{thermistor}}{I}$ $= \frac{1.364}{0.0136} = 100\Omega$ From graph, temperature = 60 °C	**1** **1** **1**	**3**
7a	The compass needle will turn from left to right alternately according to the frequency of the AC power supply.	**1**	**1**
7aii	The solenoid will become an electromagnet whose polarity alternates according to the frequency of the AC power supply. When the right of the solenoid becomes north pole, it will repel the compass needle, when it alternates to south pole, it will attract the compass needle. This caused the needle to turn left to right alternately.	**1** **1**	**2**
7bi	The fuse blow as a short circuit is created, causing an increased current to melt the fuse.	**1**	**1**
7bii	After the fuse blow, current travel through the solenoid causing it to become an electromagnet, thus causing the compass needle, which is also a magnet to move.	**1**	**1**
7biii	The needle will point to the right (away from the solenoid).	**1**	**1**
8ai	The magnet drops **down at constant acceleration of *g* in the plastic portion of the pipe due to effects of gravity**.	**1**	**1**

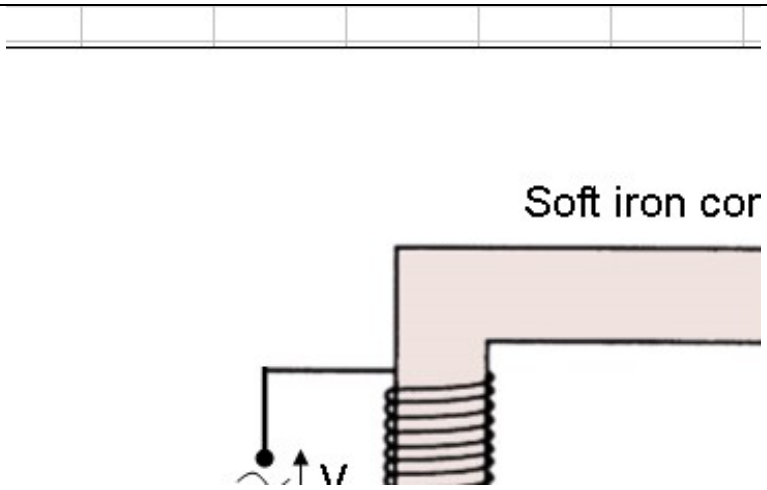
8aii	As it drops down the copper portion of the pipe, **it causes a change in magnetic field which induces a current.** The **induced current creates an opposing magnetic force (Lenz's law)** which causes the **acceleration of the magnet to decrease.**	1 (Lenz's law) 1 (motion)	2
8b		1 mark for each section of graph	2
9a	Any one : • Wear protective clothing made of lead • Work behind a shield made of lead • Wear film badge to detect exposure to radiation • Use tongs, tweezers, forceps to handle radioactive substance	1	1
9bi	Radioactive emission is random / unpredictable OR Background radiation is random	1	1
9bii	They have stronger penetration ability which can cause harm to user OR The ionizing effects are stronger.	1	1
10a	90 – 38 = 52	1	1
10b	$^{90}_{38}Sr \rightarrow \overset{90}{\underset{39}{Y}} + \overset{0}{\underset{-1}{\beta}}$	1 (for Y) 1(for β)	2
10c	No. of half life cycles = 87 years / 29 years = 3 Remaining atoms = $(1/2)^3 \times 6.0 \times 10^8$ $= 75 \times 10^6$	1 1	2

11a	**(a)** Draw the corresponding Fig 10.3.  	1	1
11b	Taking moments about pivot, Sum of CW moments = Sum of ACW moments $(W_1 + 20)\ 0.5 = 35\ (1.0)$ $W_1 = 50$ N	 1 1	2
11bii	At point B, Taking moments about pivot $(W_2 + 20)\ 0.5 = 32\ (1.0)$ $W_2 = 44$N Mass of water that turned to steam = (50 -44) N / 10 N/kg = 0.6 kg	 1 1	2
11ci	$Q = m\ c\ \Delta\theta$ $2000\ (200) = 1.0 \times c \times (100 - 20)$ c = 5000 J / kg k	 1 1	2
11cii	$Q = mI$ $2000\ (700) = 0.6\ I$ $I = 2.33 \times 10^6$ J / kg	 1 1	2
11d	The assumption is that no heat supplied by the heater is lost to the surroundings OR All heat supplied by heater is used to heat up the container and its content.	1	1
12a(i)	South	1	1
12a(ii) 1	When there is no current in the wire, **the balance measures the mass of the apparatus resting on it**. When 2.0 A current flows from X to Y, the wire experiences a **downward force** as given by Fleming's Left-Hand Rule. This causes the reading on the balance to increase by 2.6 g.	1 1	2

12a(ii) 2	When 3.0 A current flows from Y to X, the wire experiences a **larger** upward force **due to larger current flowing in the opposite direction**. This causes the reading on the balance to decrease by 3.9 g.	1 (increase in current) 1 (direction)	2
12b(i)		1	1
12b(ii)	When current flows through the sides AB and CD, the magnetic field around the current interacts with the magnetic field between the poles of the magnet, resulting in a force exerted on sides AB and CD. The direction of the force is determined by Fleming's Left-Hand Rule.	1 1	 2
12b(iii)	The current in the coil reverses due to the split rings connected to the coil exchanging contact with the carbon brushes when the coil rotates past the vertical position. Hence the force on the side AB is now upwards and the force on side CD is downwards. The coil remains rotating in the same direction.	1 1	 2

SECTION B: 10 Marks (Choose 1 out of 2 questions)

Qn. No.	*Scoring Points*	*Marks*	*Max. Marks*
13a	Energy cannot be created or destroyed. It can only be converted from one form to another.	1	1
13b	GPE = mgh = 500 x 10 x 30 = 150 000 J	 1 1	 2
13c	KE = GPE at A – GPE at C = 150 000 – 500 x 10 x 10 = 100 000 J $\frac{1}{2}mv^2 = 100\,000$ $\frac{1}{2} \times 500 \times v^2 = 100\,000$ $v = 20$ m/s	 1 1 1	 3
13d	• No • As the carriage goes round part of a horizontal circle, its direction changes and hence velocity, which is speed in a specified direction, changes.	1 1	 2
13e	F = ma - 3000 = 500 x a a = - 6 m/s^2 deceleration = 6 m/s^2	 1 1	 2

14a	 Transformer B is a step down transformer consisting of primary coil, secondary coil and laminated soft iron core. When an **alternating current flows in the primary coil, it creates a continually changing magnetic field in the soft iron core.** **As the primary coil is linked to the secondary coil, the continually changing magnetic field produces an induced emf in the secondary coil.(Faraday's law)** The induced emf, which is smaller than emf of ac supply, is proportional to the number of turns in the primary and secondary coil according to formula (Np / Ns = Vp / Vs) As transformer B has more turns in the primary coil compared to secondary coil, it is able to step down voltage from 400 kV to 200 V.	1 mark for correct structure and showing more coils on primary than secondary 1 1 1	4
14b	$\frac{N_P}{N_S} = \frac{V_P}{V_S}$ $= \frac{25}{400} = \frac{1}{16}$	1	1
14c	Since transformer is ideal. Input power = output power $V_p I_p = V_s I_s$ $25(12000) = 400\ I_s$ $I_s = 750$ A	1 1	2
14d	$P_{loss} = I^2 R$ $= 750^2\ (1000)$ $= 5.63 \times 10^8$ W	1	1

14e	Power loss in cables is given by $P_{loss} = I^2 R$. By stepping up the transmission voltage, current in the cable will be reduced, hence reducing energy loss due to heating effect of current/ Thicker transmission cables which have smaller resistance also help reduce the power loss in cable.	 1 1	2