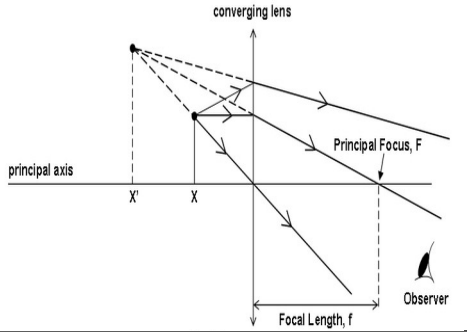
Marking Scheme for 4E 2023 Physics Prelim P1

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
C	B	D	B	A	B	D	D	D	B
Q11	**Q12**	**Q13**	**Q14**	**Q15**	**Q16**	**Q17**	**Q18**	**Q19**	**Q20**
D	D	A	B	C	C	D	D	C	B
Q21	**Q22**	**Q3**	**Q24**	**Q25**	**Q26**	**Q27**	**Q28**	**Q29**	**Q30**
B	A	D	D	C	C	A	A	D	C
Q31	**Q32**	**Q33**	**Q34**	**Q35**	**Q36**	**Q37**	**Q38**	**Q39**	**Q40**
D	B	C	C	A	C	B	D	C	A

Marking Scheme for 4E 2023 Physics Prelim P2

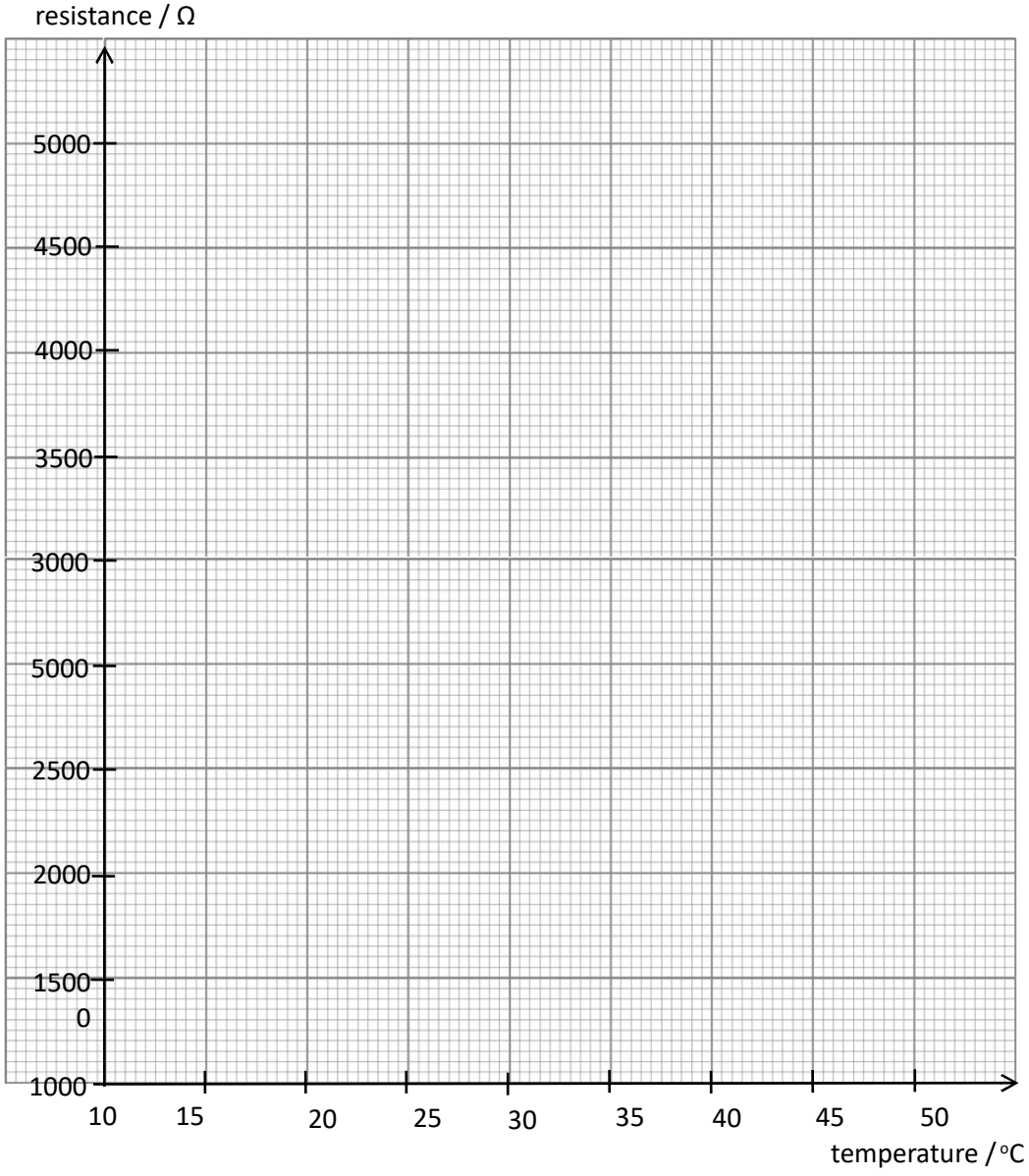
Section A

Qn	Answers	Mark
1ai	• **Gradient** of the graph [1]	1
1aii	4 min = 240 s [1] (as long as student use this in Any part of the working) $a = \frac{v-u}{\Delta t}$ or gradient $= \frac{-2-2}{240}$ $= -0.017 m/s^2$ [1] **1m only if a is positive **(correct value) + t is correct value**	2
1b	• **Displacement** of the car [1] *do not accept "distance"	1
1c	• At 120 s or 2 min [1]	1
1d	$Displacement_1 = Area_1$ $= \left(\frac{1}{2}\right)(2\times 60)(2)$ $= 120m$ (120m to Left) $Displacement_2 = Area_2$ $= \left(\frac{1}{2}\right)(6\times 60)(-4)$ $= -720m$ (720m to Right) Total $Displacement = 120 + (-720)$ [1] $= -600m$ (600m to Right) [1] Direction = right/opposite direct (B.O.D) [1] **Displacement➔ no penalty if student use t in min **Direction ➔ no mark for "negative direction or backwards"	3
2a	$F_{net} = ma$ $F - 1.8 - 9.0 = (18)(2.0)$ [1] $F = 47N$ [1]	2
2b	$F_{net} = ma$ $F_{AB} - 9.0 = (15)(2.0)$ [1] $F = 39N$ [1]	2

3a	• A point where all the weight **appears/considered** to act on. [1]	1
3b	$Moment_{anti-clockwise} = Moment_{clockwise}$ $(810)(0.80) = (400)(x)$ [1] $x = 1.62m$ [1]	2
3c	$Force = 810 + 400 + 40$ $= 1250N$ or $1300N$ [1]	1
4ai	$n = \frac{\sin(\theta \text{ less dense})}{\sin(\theta \text{ denser})}$ $1.5 = \frac{\sin(40^o)}{\sin(\theta \text{ denser})}$ [1] θ denser $= 25.4^o$ or 25^o [1]	2
4aii	$n = \frac{\sin(\theta \text{ less dense})}{\sin(\theta \text{ denser})}$ $1.5 = \frac{\sin(90^o)}{\sin(\theta \text{ c})}$ θ c $= 41.8^o$ OR *The angle of incidence @ AB is* 19.6^o [1] **(Prove 01 angle)** • Since **Angle i_{AB} < angle C** [1] • **TIR** will **not occur**. [1]	3
4bi	• Principal Focus F correctly **positioned** & **Labelled** correctly [1] • using **one/two OTHER light rays with correct dotted** and **solid portions** with **arrow** [1] • Completing the **existing one** ray with **correct dotted** and **solid portions** and direction. [1] 	3
4bii	• Image will be **dimmer/less bright OR intensity** will be **reduced** [1]	1
5a	$wavelength = \frac{7.8}{2}$ $= 3.9m$ [1]	1
5b	$v = f\lambda$ $v = \left(\frac{1}{4.0}\right)(3.9)$ [1] $= 0.975m$ or $0.98m$ [1] OR $v = \frac{Dist}{time}$ $v = \frac{7.8}{8.0}$ [1] $= 0.975m$ or $0.98m$ [1]	2
5c	• 4.0s [1]	1
5d	• **speed** @ Q is **lower/decreased** or the wave is **slower** [1] • **frequency** remains the **same/constant** [1] • **depth** of sea @ Q is **shallower/decreases** [1]	3

6a	• Friction between **car and air** causes **electrons to be lost,** [1] • Making the car positively charged. **student's answer must state/display knowledge that the surfaces mentioned is between the car & air.	1
6b	Any sensible answer: • **Tyres** are **non-conductors** or **Tyres** act as **insulating material** between car and ground. [1]	1
6c	• Metal strap conducts **electrons** from the **ground to the car** [1] • to **neutralise the positive charges** on the car [1]	2
7a	• Reading of Ammeter A1: increases • Reading of Ammeter A2: increases • Reading of Voltmeter V1: no change • Reading of Voltmeter V2: increases (2 correct =1 mark, 3 correct = 2 marks, 4 correct = 3 marks)	3
7b	$R_{total} = R_{//} + 500\Omega$ $= \left(\frac{1}{1000} + \frac{1}{500}\right)^{-1} + 500$ $= 833\Omega$ [1] $V = IR$ $I = \frac{10}{833}$ $= 0.012$ [1] **1 mark for value of I if R_{total} is calculated wrongly	1
8a	• The index finger (magnetic field) is **perpendicular** to middle finger (current) [1] • The **direction of the force is perpendicular to the current and the magnetic field lines** + The force induced (thumb) on the U frame will be **upwards/out of paper**. [1] • Causing the U frame to rotate **Anti-Clockwise/upwards.** [1]	3
8b	**(OWTTE)** • Parallel wires carrying current in the same direction. • Has a **stronger magnetic field at its exterior** as compared to its **interior**. OR N**-pole on right side & S-pole of left side** of each **turn** OR **opposite pole**s between each **turn** [1] • This results in a **net attractive force** [1] • Pushing the coil of wire together/closer.	2
9a	$\frac{V_S}{V_P} = \frac{N_S}{N_P}$ $V_S = \frac{72}{1440} \times 240$ [1] $= 12V$ [1]	2
9b	$P_S = \frac{V_S^2}{R}$ $= \frac{12^2}{600}$ [1] $= 0.24W$ [1]	2
9c	• The transformer has an efficiency of 100%. • No heat loss to the surroundings (any one)	1

Section B

Qn	Answers	Mark
10a	• An electronic device that **convert non-electrical energy to electrical energy**. [1]	1
10bi	As temperature increases, the resistance of the thermistor decreases • [1] ➔ at **a decreasing rate.** OR ➔ From 14 °C to 18 °C, **the decrease is 760 per 4 degree Celsius**. ➔ From 40 °C to 44 °C, **the decrease is 200 per 4 degree Celsius**. **(Compare any range)**	1
10bi & bii	points all plotted correctly = 1 mark good curve = 1 mark  	2
10ci	• As temperature increases, **resistance of transducer decreases**. + As p.d is proportionate to resistance, the **p.d across transducer decreases** [1] • Since **total pd remains constant**, pd of 4800Ω/Vout increases. [1]	2
10cii	• Final voltage across transducer = 12 – 7.2 = 4.8 V • Final resistance of transducer = 4.8 × 4800=3200 Ω [1] • When resistance is 3200, temperature = 24°C. (refer to from student's graph) [1]	2

10ciii	**(OWTTE)** When the lamp is connected in parallel, • the effective/total resistance in parallel (R//) decreased. • This cause **pd across R// or lamp** will **reduce/drop** OR **pd across transducer** will be **higher** [1] • Thus **power** output of lamp will be **reduced/lowered** [1] • Hence the lamp will be much dimmer.	2
11a	• Gases are highly **compressible**. [1] • Gas molecules are **very far apart** / **large intermolecular distance** / **very weak intermolecular force**/**attractive force** between them. [1]. *Do not accept "force"	2
11b	• The molecules collide with the wall of the container and exert an **average force** on the wall. [1] • The (average) **force per unit area** exerted by the gas molecules on the wall of the container is the gas pressure. [1]	2
11c	**(OWTTE)** • Gas molecules are in **continuous random motion** / **no preferred direction** [1] • At each instant, there will be **as many molecules** colliding with **one part of** • the wall, as there will be for **other parts.** [1]	2
11d	As volume decreases, • the number of gas molecules per unit volume increases. • The **rate of collision of the gas** molecules with the wall of the container **increases** [1] and • The force exerted per unit area will increase. • And thus the **pressure** exerted will **double** [1].	2
11e	• The **number of molecules** remain the **same** [1]	1
11f	• During heating, the **kinetic energy** of the particles increases + The particles **move faster** /**speed increases** [1] • The particles are further apart from each other.	1

12 Either		
a	$depth = 5 - 2$ $= 3m$ [1] (accept 1sf/whole number)	1
B	• 10J (pond surface as reference pt) OR 25J (bottom of pond as reference pt) [1]	1
c	• Air resistance is negligible/No energy is lost to the surroundings [1]	1
d	$E_K = \frac{1}{2}mv^2$ $10 = \frac{1}{2}(0.5)v^2$ [1] $v = 6.32m/s$ or $6.3m/s$ [1]	2

e	$dist = \frac{1}{2}(v)(t)$ $2 = \frac{1}{2}(6.32)(t)$ [1] $t = 0.632s$ or $0.63s$ [1]	1
fi	• The **velocity** of the bob is increasing **at decreasing rate** OR **Resistive force** (in pond/water) is **increasing** OR **acceleration** of the bob is **decreasing**. [1] • Thus the **resultant force** acting on the bob is **decreasing** [1]	2
fii	• Object is moving at **constant speed** / **terminal velocity** OR **acceleration** is **zero** [1] • The **resultant force** acting on the bob is **zero** [1]	2

12 OR		
A	X = 2160 or 2200 g [1] Y = 1440 or 1400 g [1] Z = 6400 g [1]	3
b	• Heat capacity is the **amount of thermal energy** required to raise the temperature of a cookware **by 1 °C** [1]	1
ci	• Water in **pot/metal Y** will be the first to boil. [1] • because the **heat capacity** of metal Y (216 J/°C) is the **lowest.** **OR** For the **same** amount of **thermal energy supplied**, **temperature** of metal Y will **increase the most**. **OR** **Thermal energy** required for **temperature** of metal Y to **increase by** 1°C is the **smallest.** [1] • For the same amount of thermal energy supplied, water in the pot Y will be heated up faster.	2
cii	• Water in **pot/metal Z** will be the at the highest temperature [1] • because it has the **highest heat capacity** **OR** For the **same amount of thermal energy lost**, **temperature** of metal Z will dropped by **the least.** **OR** **thermal energy** needed for the **temperature** of metal Z to **drop 1°C** is the **highest**. [1] • And thus the water (inside Z) will be still be highest	2
d	• Heat loss **to the surrounding** for all three pots is the **same /negligible**. [1] • **Power output** (of heater) is **consistent/constant** during the heating process. [1] **no mark if student writes “heat absorbed (by pots) is the same”	2