Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic: Electricity

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Name of the Student:_____
Max. Marks : 24 Marks **Time :** 24 **Minutes**

Q1.

(a) State what is meant by the emf (electromotive force) of a battery.

_____

_____

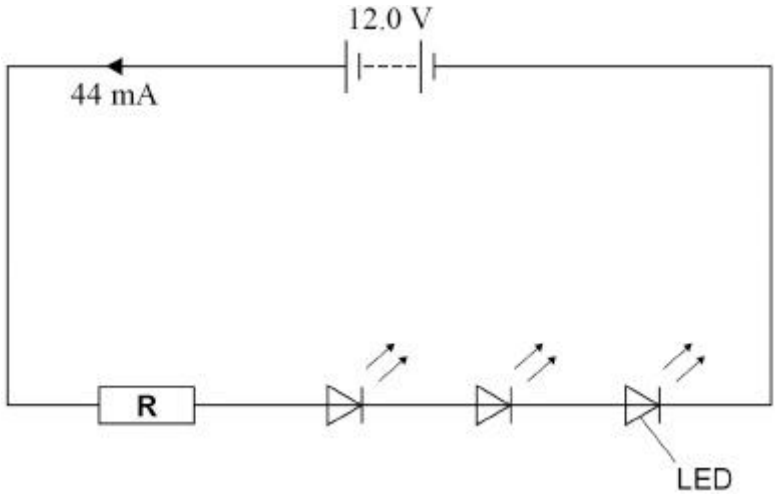
_____

_____

(1)

Figure 1 shows the circuit diagram for a battery-powered torch.
The circuit contains three identical light emitting diodes (LEDs) and a resistor **R**.
The current in the circuit is 44 mA.

Figure 1



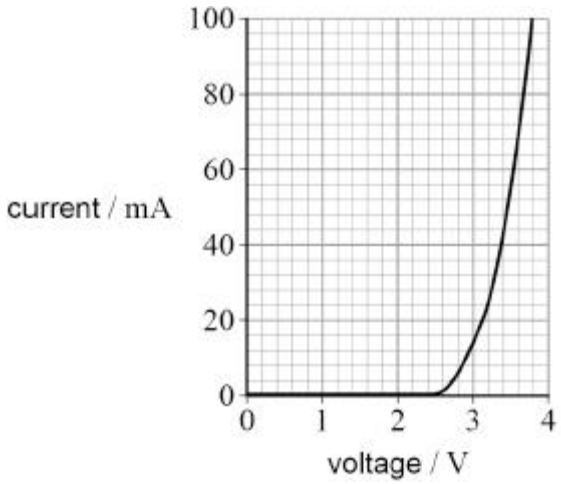
(b) Calculate the number of electrons that pass a point in the circuit in 37 minutes.

number of electrons = _____

(2)

Figure 2 is the current–voltage characteristic for an LED used in the torch.

Figure 2



(c) Determine the power output of one LED when the torch is on.

power output = _____ W

(3)

The battery has an emf of 12.0 V and an internal resistance of 1.5 Ω.

(d) Determine the resistance of **R** in **Figure 1**.

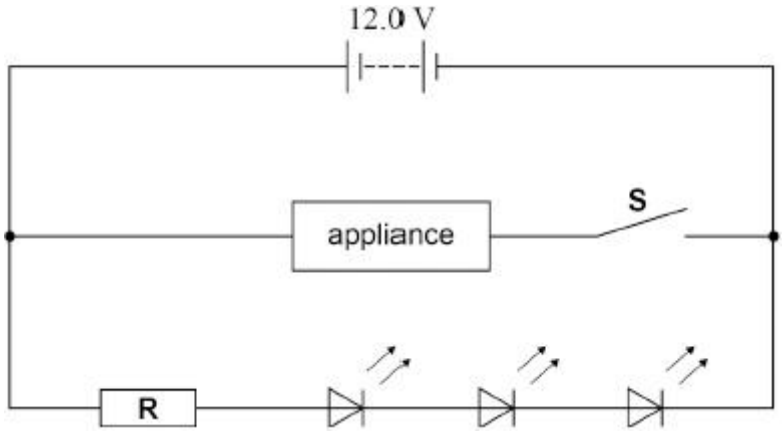
resistance = _____ Ω

(4)

(e) Another appliance is connected to the battery as shown in **Figure 3**.

The current in the battery is 3.5 A when switch **S** is closed.

Figure 3



Each LED requires a voltage of at least 2.9 V to light.

Deduce whether the LEDs will light when **S** is closed.

_____

_____

_____

_____

_____

_____

_____

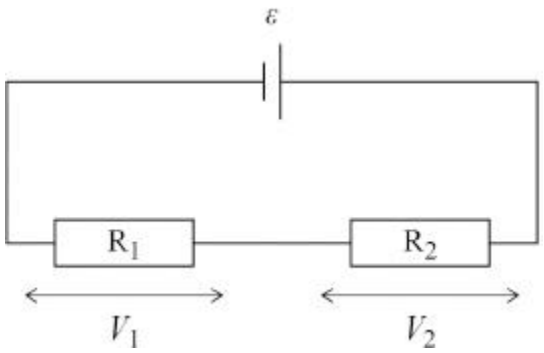
(3)

(Total 13 marks)

Q2.

(a) In **Figure 1** the cell has emf ε and internal resistance r.

Figure 1



The current in the circuit is I.

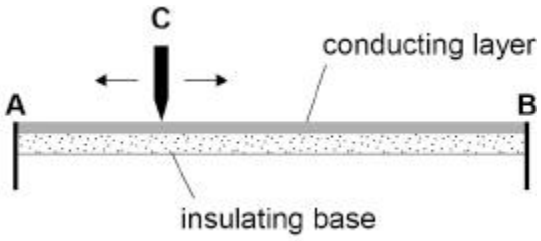
The potential difference (pd) across R_1 is V_1 and the pd across R_2 is V_2.

Explain how the law of conservation of energy applies in this circuit.
You should consider the movement of one coulomb of charge around the circuit.

(2)

Figure 2 shows a variable resistor made with a thin conducting layer on an insulating base.

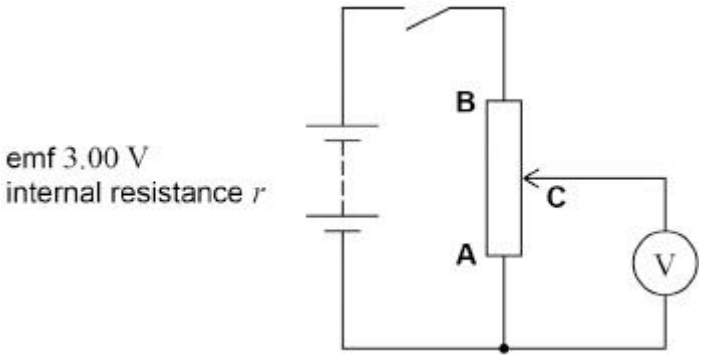
Figure 2



The conducting layer has constant width and thickness and has connections at the ends **A** and **B**.
C is a sliding contact that can move along the surface of the conducting layer between **A** and **B**.

Figure 3 shows a circuit that uses the variable resistor as a potential divider.

Figure 3



The variable resistor is connected to a battery of emf 3.00 V and internal resistance *r*. The resistance of the conducting layer between **A** and **B** is 125 Ω.

(b) The sliding contact **C** is moved to end **B** of the variable resistor. The switch is closed. The digital voltmeter reads 2.89 V.

Show that r is approximately 4.8 Ω.

(3)

(c) **C** is set at $\frac{1}{5}$ of the distance between **A** and **B**. The thickness of the conducting layer is uniform so the resistance between **A** and **C** is 25.0 Ω.

Determine the voltmeter reading at this setting.

voltmeter reading = _____ V

(2)

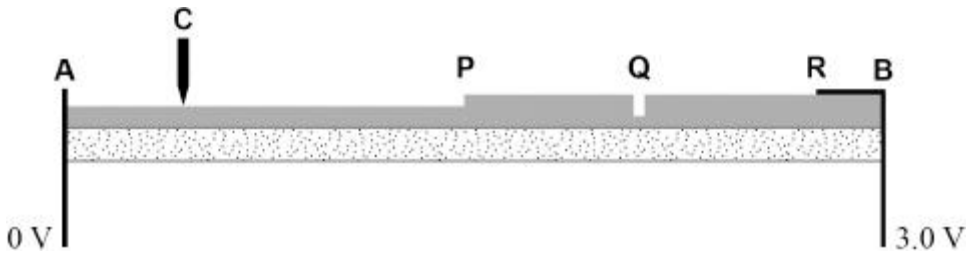
(d) **Figure 4** shows a variable resistor similar to the one shown in **Figure 2** but with the following three manufacturing faults:

- at **P** the conducting layer changes in thickness so that **AP** is thinner than **PB**
- at **Q** there is a scratch into the surface of the conducting layer and across its full width
- from **R** to **B** the conducting connector is laid over the conducting layer.

The width of the conducting layer is constant.

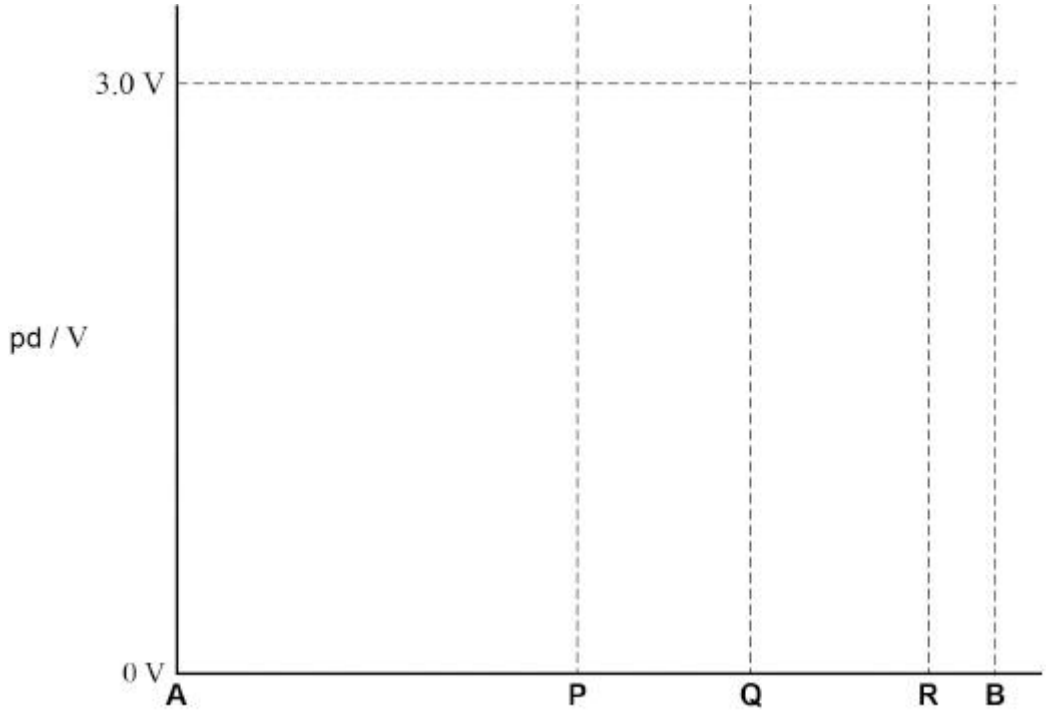
A pd of 3.0 V is applied across **A** and **B**.
C is moved from **A** to **B**.

Figure 4



Sketch, on the axes in **Figure 5**, a graph to show how the pd between **A** and **C** varies as **C** is moved from **A** to **B**.

Figure 5



(4)

(Total 11 marks)