Name of the Student:_____
Max. Marks : 22 Marks **Time : 22 Minutes**

Q1.

(a) (i) Describe how you would make a direct measurement of the emf $\mathcal{E}$ of a cell, stating the type of meter you would use.

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_____

(1)

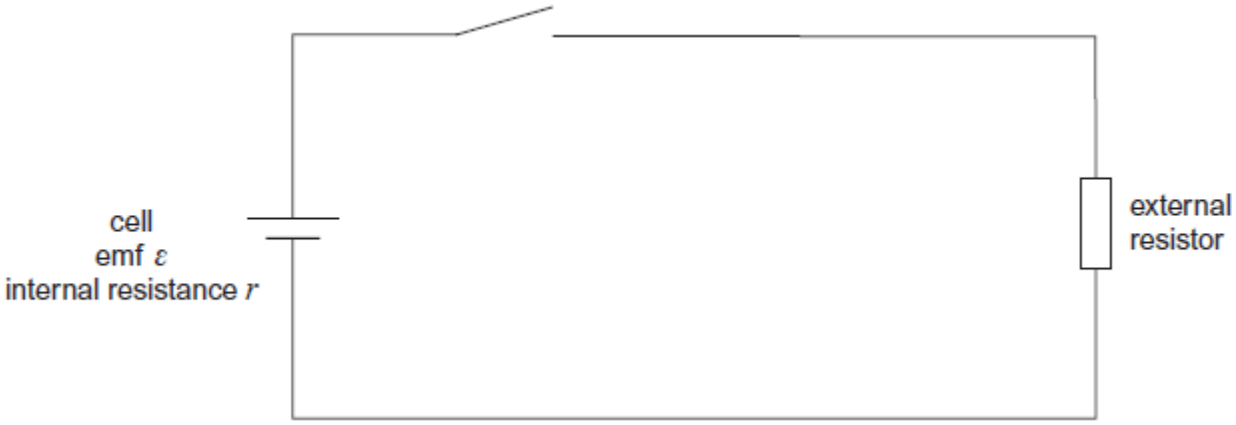
(ii) Explain why this meter must have a very high resistance.

_____

_____

(1)

(b) A student is provided with the circuit shown in the diagram below.



The student wishes to determine the efficiency of this circuit.

In this circuit, useful power is dissipated in the external resistor. The total power input is the power produced by the battery.

$$\text{Efficiency} = \frac{\text{useful power output}}{\text{total power input}}$$

The efficiency can be determined using two readings from a voltmeter.

(i) Show that the efficiency = $\frac{V}{\varepsilon}$ where $\mathcal{E}$ is the emf of the cell

and V is the potential difference across the external resistor.

(1)

(ii) Add a voltmeter to the diagram and explain how you would use this new circuit to take readings of ε and V.

(2)

(c) Describe how you would obtain a set of readings to investigate the relationship between efficiency and the resistance of the external resistor. State any precautions you would take to ensure your readings were reliable.

(2)

(d) State and explain how you would expect the efficiency to vary as the value of R is increased.

(2)

(Total 9 marks)

Q2.

Complete the following table by stating whether the quantity is a vector or a scalar and by giving the full name of its unit.

Quantity	Vector or Scalar	S.I. Unit
force	vector	newton
displacement		
kinetic energy		
power		

(Total 3 marks)

Q3.

(a) Starting with the relationship between impulse and the change in momentum, show clearly that the unit, N, is equivalent to kg m s^{-2}.

(2)

(b) A rocket uses a liquid propellant in order to move.
Explain how the ejection of the waste gases in one direction makes the rocket move in the opposite direction.

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_____

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_____

_____

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_____

(3)

(c) A rocket ejects 1.5×10^4 kg of waste gas per second. The gas is ejected with a speed of 2.4 km s^{-1} relative to the rocket. Show that the average thrust on the rocket is about 40 MN.

(2)

(Total 7 marks)

Q4.

Complete the following table.

Quantity	Vector or Scalar	S.I. Unit
Displacement	Vector	m
Velocity		
Weight		
Energy		

(Total 3 marks)