

Name of the Student: _____

Max. Marks : 22 Marks

Time : 22 Minutes

Q1.

A homeowner had a new gas boiler installed.

- (a) The following information is an extract from the information booklet supplied with the boiler.

Fuel	Natural Gas
Water temperature	60 °C
Energy supplied to gas boiler	8.0 kJ/s (8.0 kW)
Efficiency	0.95

- (i) Calculate the energy transferred each second by the gas boiler to the water inside the boiler.

Show clearly how you work out your answer.

Energy transferred by the gas boiler each second = _____ kJ

(2)

- (ii) The energy value of the gas used in a home is measured in kilowatt-hours (kWh).

The homeowner has a pre-payment meter and pays £30 into his account. With a pre-payment meter, gas costs 15p per kilowatt-hour.

Calculate the total number of hours that the gas boiler would operate for £30.

Show clearly how you work out your answer.

Number of hours = _____

(2)

- (b) Although the gas boiler is very efficient, some energy is wasted.

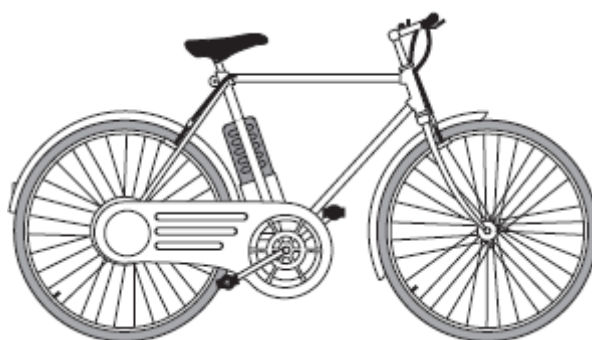
Explain what happens to the waste energy.

(2)

(Total 6 marks)

Q2.

The picture shows an electric bicycle. The bicycle is usually powered using a combination of the rider pedalling and an electric motor.



- (a) A 36 volt battery powers the electric motor. The battery is made using individual 1.2 volt cells.

- (i) Explain how a 36 volt battery can be produced using individual 1.2 volt cells.

To gain full marks, you must include a calculation in your answer.

(2)

- (ii) The battery supplies a direct current (d.c.).

What is a *direct current (d.c.)*?

(1)

- (iii) When fully charged, the battery can deliver a current of 5 A for 2 hours. The battery is then fully discharged.

Calculate the maximum charge that the battery stores.

Show clearly how you work out your answer and give the unit.

Charge stored = _____

(3)

- (b) When powered only by the electric motor, the bicycle can carry a 90 kg rider at a maximum speed of 6 m/s. Under these conditions, the maximum distance that the bicycle can cover before the battery needs recharging is 32 km.

The bicycle has a mass of 30 kg.

- (i) Calculate the maximum kinetic energy of the bicycle **and** rider when the rider is not pedalling.

Show clearly how you work out your answer.

Kinetic energy = _____ J

(2)

- (ii) The bicycle can be fitted with panniers (bags) to carry a small amount of luggage.

What effect would fitting panniers and carrying luggage have on the distance the bicycle can cover before the battery needs recharging?

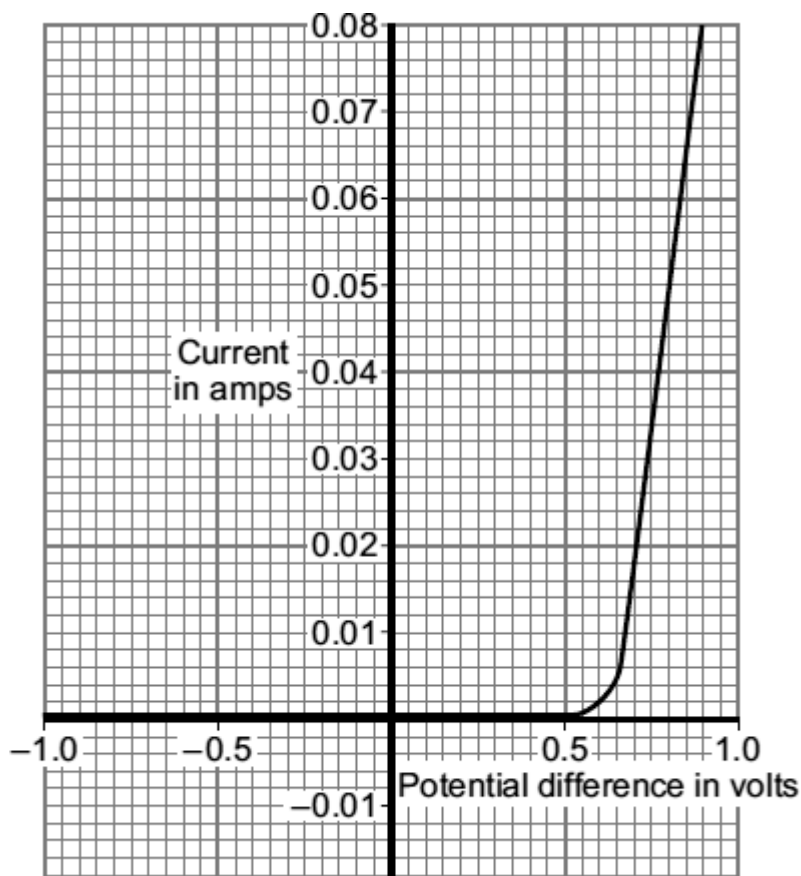
Give a reason for your answer.

(2)

(Total 10 marks)

Q3.

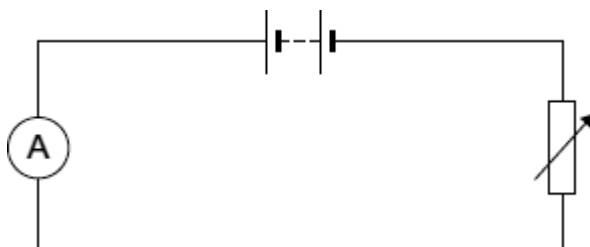
The current-potential difference graph for one type of electrical component is drawn below.



(a) What is the component?

(1)

(b) Complete the diagram to show a circuit that can be used to obtain the data needed to plot the graph. Use the correct circuit symbol for each component that you add to the diagram.



(2)

(c) (i) What is the current through the component when the potential difference across the component is 0.8 volts?

Current _____ amps

(1)

(ii) Calculate the resistance of the component when the potential difference across it is 0.8 volts.

Show clearly how you work out your answer.

Resistance = _____ Ω (2)
(Total 6 marks)