1 (a) A man monitors how much money he spends on electricity.
He uses a device which calculates the cost of electrical energy used.
He connects his 2.9 kW electric kettle to the 230 V mains supply.

(i) Calculate the current in the kettle element.

(3)

current = ... A

(ii) The device shows that in one week the total cost of the electrical energy used by the kettle is 97 p.
1kW h of electrical energy costs 17 p.

Calculate the length of time for which the kettle has been switched on during the week.

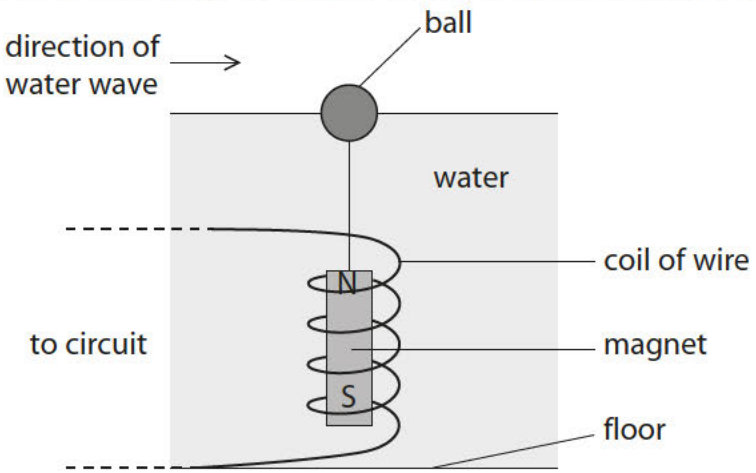
(3)

time = ...hours

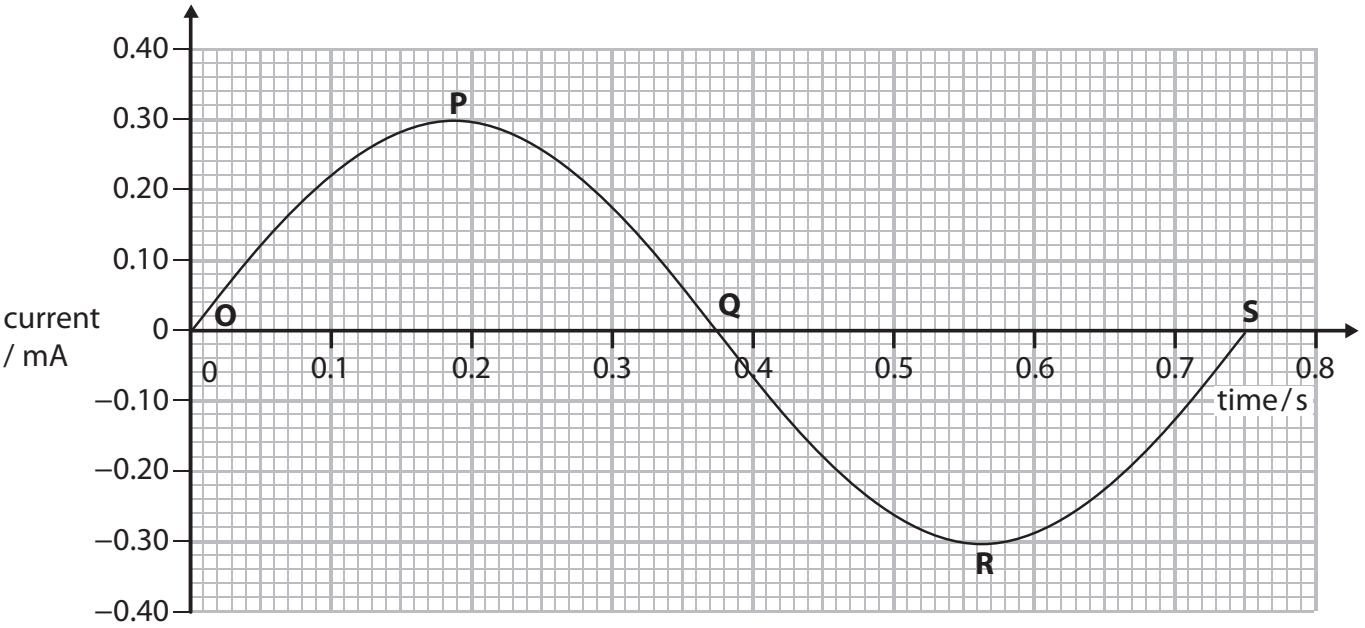
*(b) The diagram shows a model used to generate electricity from water waves in a tank.

A ball floats on the surface of the water in the tank.
A coil of wire is fixed to the floor of the tank.
A magnet is suspended from the ball inside the coil.

When a wave is sent along the surface of the water the ball moves up and down.



The graph shows the current induced in the coil.



Explain how this current is induced in the coil in the model.
You should refer to the model and to the labelled points on the graph in your answer.

(6)

(Total for Question 6 = 12 marks)

Using electricity

2 (a) Complete the sentence by putting a cross (☒) in the box next to your answer.

An electric current is the rate of flow of

(1)

- ☐ **A** atoms
- ☐ **B** charge
- ☐ **C** voltage
- ☐ **D** watts

(b) An electric kettle is connected to a mains voltage of 230 V.
The current in the kettle is 12 A.

Calculate the power of the kettle.

(2)

power of the kettle = ... W

(c) A television has a power of 400 W.
The cost of 1 kW h of electrical energy is 15p.

Calculate the cost of using the television for 10 hours.

(3)

cost of using the television for 10 hours = ... p

*(d) Some students found this information about an energy saving lamp and a filament lamp that give out almost the same amount of light.

energy saving lamp

power = 15 W

cost = £1.50

lifetime = 10 000 hours

produces 20 J of light energy for each 100 J of electrical energy supplied

filament lamp

power = 60 W

cost = £0.30

lifetime = 1 000 hours

produces 5 J of light energy for each 100 J of electrical energy supplied

Describe the advantages and disadvantages of each type of lamp.

(6)

(Total for Question 5 = 12 marks)

3 (a) Complete the sentence by putting a cross (☒) in the box next to your answer.

The output power of a solar panel is the rate of transfer of

(1)

☒ **A** current

☒ **B** electrons

☒ **C** energy

☒ **D** voltage

(b) A solar panel generates direct current.

(i) Describe the difference between direct current and alternating current.

(2)

(ii) The output from the solar panel is 60 V.

State why a transformer cannot be used to increase this voltage.

(1)

(c) Homeowners are being encouraged to fit solar panels to the roofs of their homes.

Explain why using solar panels to generate electricity for the National Grid benefits the environment.

(2)

(d) A homeowner fits a solar panel to her roof.
The cost of the solar panel is £4800.
The solar panel supplies an average of 800 kW h of electrical energy to the National Grid each year.
The homeowner is paid 40p for each kW h of energy supplied to the National Grid.

Calculate the payback time for the solar panels by selling energy to the National Grid.

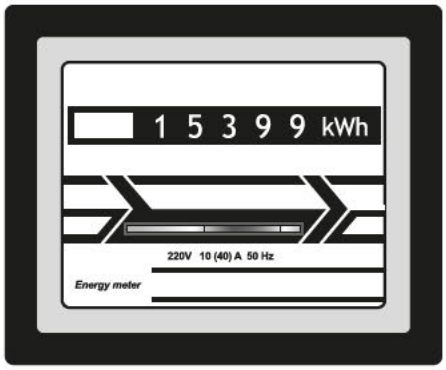
(3)

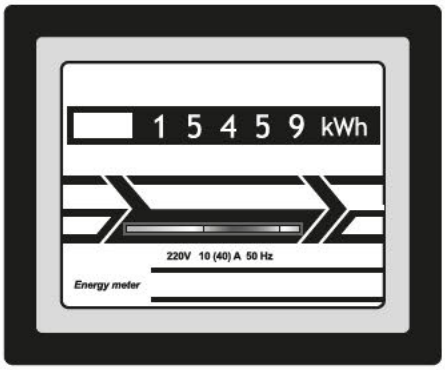
payback time = ... years

(Total for Question 3 = 9 marks)

Electrical power

4 (a) Electricity costs 20 p for each kW h.
The pictures show a domestic electricity meter at two different times.





(i) Calculate the cost of the electricity used between the two readings.

(2)

cost = ... p

(ii) The time between these two readings is 15 hours.

Calculate the average power supplied.

(2)

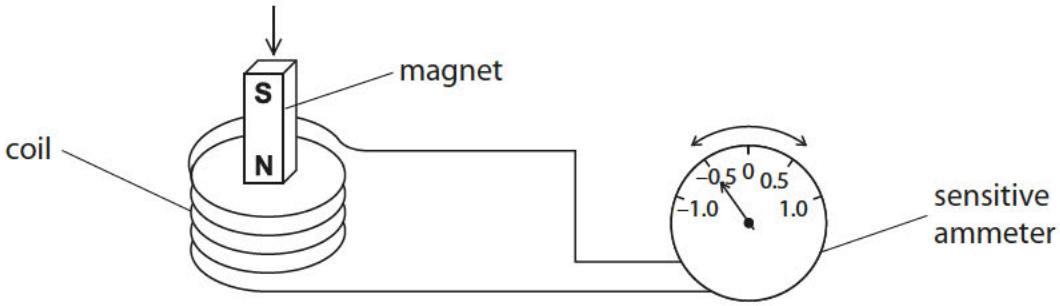
average power = ... kW

(b) Explain why step-up transformers are used in the transmission of electricity in the National Grid.

(2)

*(c) The diagram shows a magnet moving into a coil of wire.

The coil of wire is attached to a sensitive ammeter.



The moving magnet and the coil of wire are producing an electric current.

The size and direction of the current can be changed in a number of ways.

Describe changes that can be made to produce different currents and the effect of each change.

(6)

(Total for Question 6 = 12 marks)