Electricity & Magnetism

(IGCSE Physics Year 2002 Oct/Nov Paper 3-Set 1)

7 Fig. 7.1 shows an arrangement that could be used for making an electromagnet or a permanent magnet.

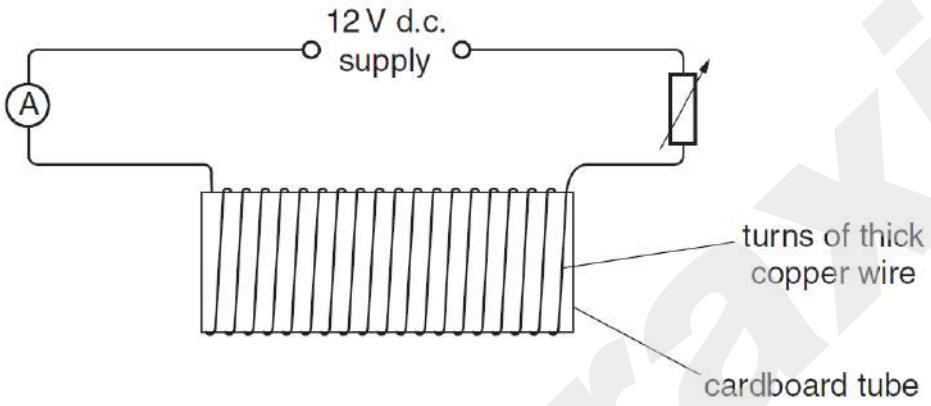


Fig. 7.1

Two bars of the same size are also available, one made of iron and the other of steel.

(a) (i) State which bar should be used to make a permanent magnet.

.....

(ii) Describe how the apparatus would be used to make a permanent magnet.

.....

.....

.....

(iii) Suggest one reason why the circuit contains an ammeter and a variable resistor.

.....

.....

[3]

(b) During the making of a permanent magnet, the ammeter reads a steady current of 4.0 A throughout the 5.0 s that the current is switched on. The voltage of the supply is 12 V.

Calculate

(i) the total circuit resistance,

resistance = ...

(ii) the power of the supply,

power = ...

(iii) the energy supplied during the 5.0 s.

energy = ...
[6]

(c) The potential difference across the variable resistor is 7.0 V and that across the ammeter is zero.

(i) Calculate the potential difference across the magnetising coil.

potential difference = ...

(ii) State the general principle used in making this calculation.

.....

.....
[3]

8 Fig. 8.1 shows a long straight wire between the poles of a permanent magnet.
It is connected through a switch to a battery so that, when the switch is closed, there is a steady current in the wire.

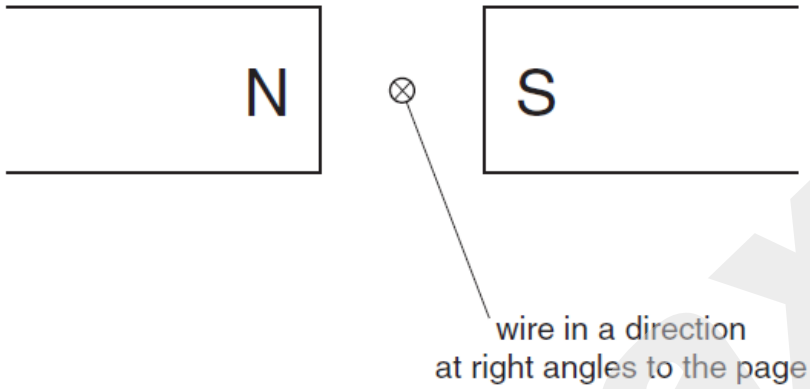


Fig. 8.1

(a) State the direction of the magnetic field between the poles of the magnet.

.....[1]

(b) The wire is free to move. The current is switched on so that its direction is into the page.

(i) State the direction of movement of the wire.

.....

.....

(ii) Explain how you reached your answer to **(b)(i)**.

.....

.....

.....

[4]

(c) This experiment is the basis of an electric motor.
Describe two changes to the arrangement shown in Fig. 8.1 that would enable continuous rotation to take place.

change 1 .....

.....

change 2 .....

.....[2]

(IGCSE Physics Year 2003 May/June Paper 3-Set 1)

8 Fig. 8.1 shows a battery with a resistor connected across its terminals. The e.m.f. of the battery is 6.0 V.

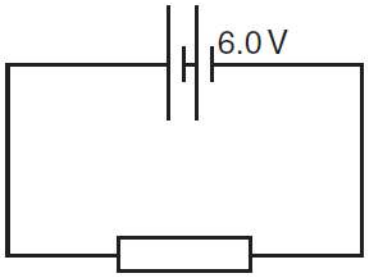


Fig. 8.1

The battery causes 90 C of charge to flow through the circuit in 45 s.

(a) Calculate

(i) the current in the circuit,

current = ...

(ii) the resistance of the circuit,

resistance = ...

(iii) the electrical energy transformed in the circuit in 45 s.

energy = ...
[6]

(b) Explain what is meant by the term *e.m.f. of the battery*.

.....

.....

.....[2]

9 A transformer has an output of 24 V when supplying a current of 2.0 A. The current in the primary coil is 0.40 A and the transformer is 100% efficient.

(a) Calculate

(i) the power output of the transformer,

power = ...

(ii) the voltage applied across the primary coil.

voltage = ...
[4]

(b) Explain

(i) what is meant by the statement that the transformer is 100% efficient,

.....

.....

.....

(ii) how the transformer changes an input voltage into a different output voltage.

.....

.....

.....

.....

[4]

10 Fig. 10.1 and Fig. 10.2 show two views of a vertical wire carrying a current up through a horizontal card. Points P and Q are marked on the card.

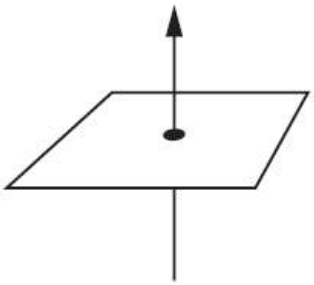


Fig. 10.1

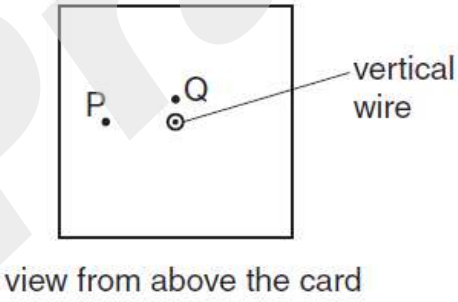


Fig. 10.2

(a) On Fig. 10.2,

(i) draw a complete magnetic field line (line of force) through P and indicate its direction with an arrow,

(ii) draw an arrow through Q to indicate the direction in which a compass placed at Q would point.

[3]

(b) State the effect on the direction in which compass Q points of

(i) increasing the current in the wire,

.....

(ii) reversing the direction of the current in the wire.

.....
[2]

(c) Fig. 10.3 shows the view from above of another vertical wire carrying a current up through a horizontal card. A cm grid is marked on the card. Point W is 1 cm vertically above the top surface of the card.

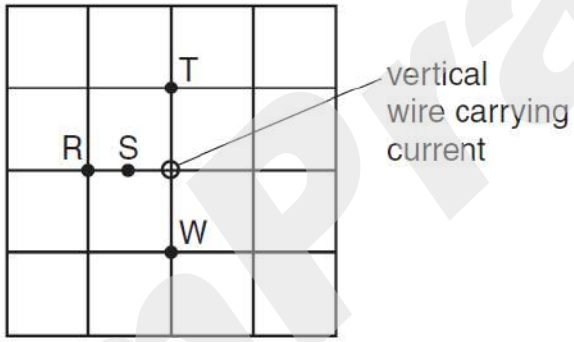


Fig. 10.3

State the magnetic field strength at S, T and W in terms of the magnetic field strength at R. Use one of the alternatives, **weaker**, **same strength** or **stronger** for each answer.

at S .....

at T .....

at W..... [3]

(IGCSE Physics Year 2003 Oct/Nov Paper 3-Set 1)

8 Fig. 8.1 shows the outline of an a.c. generator. The peak output voltage of the generator is 6.0 V and the output has a frequency of 10 Hz.

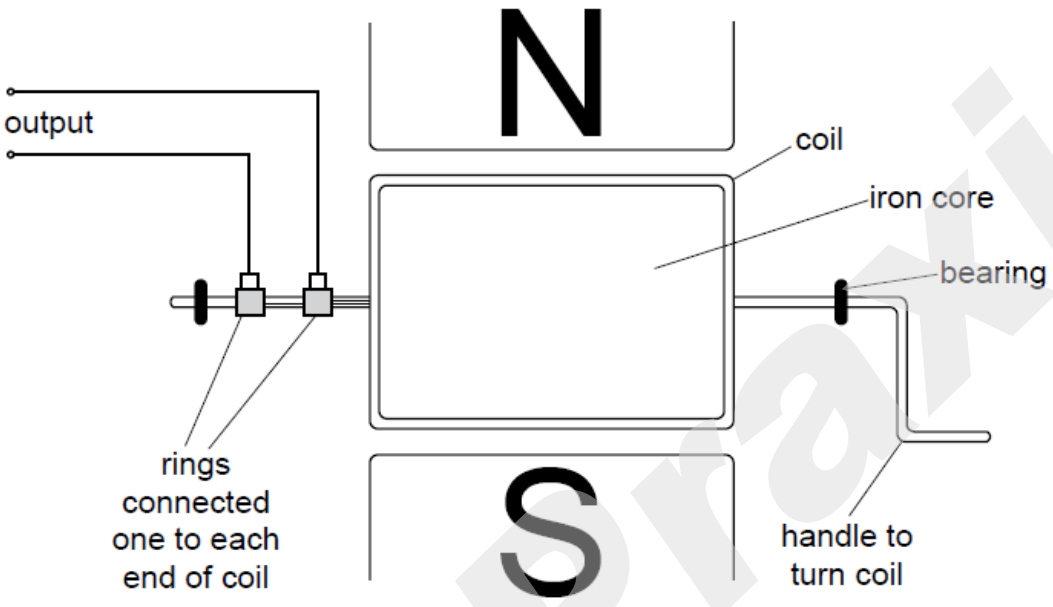


Fig. 8.1

(a) Fig. 8.2 shows the axes of a voltage-time graph for the generator output.

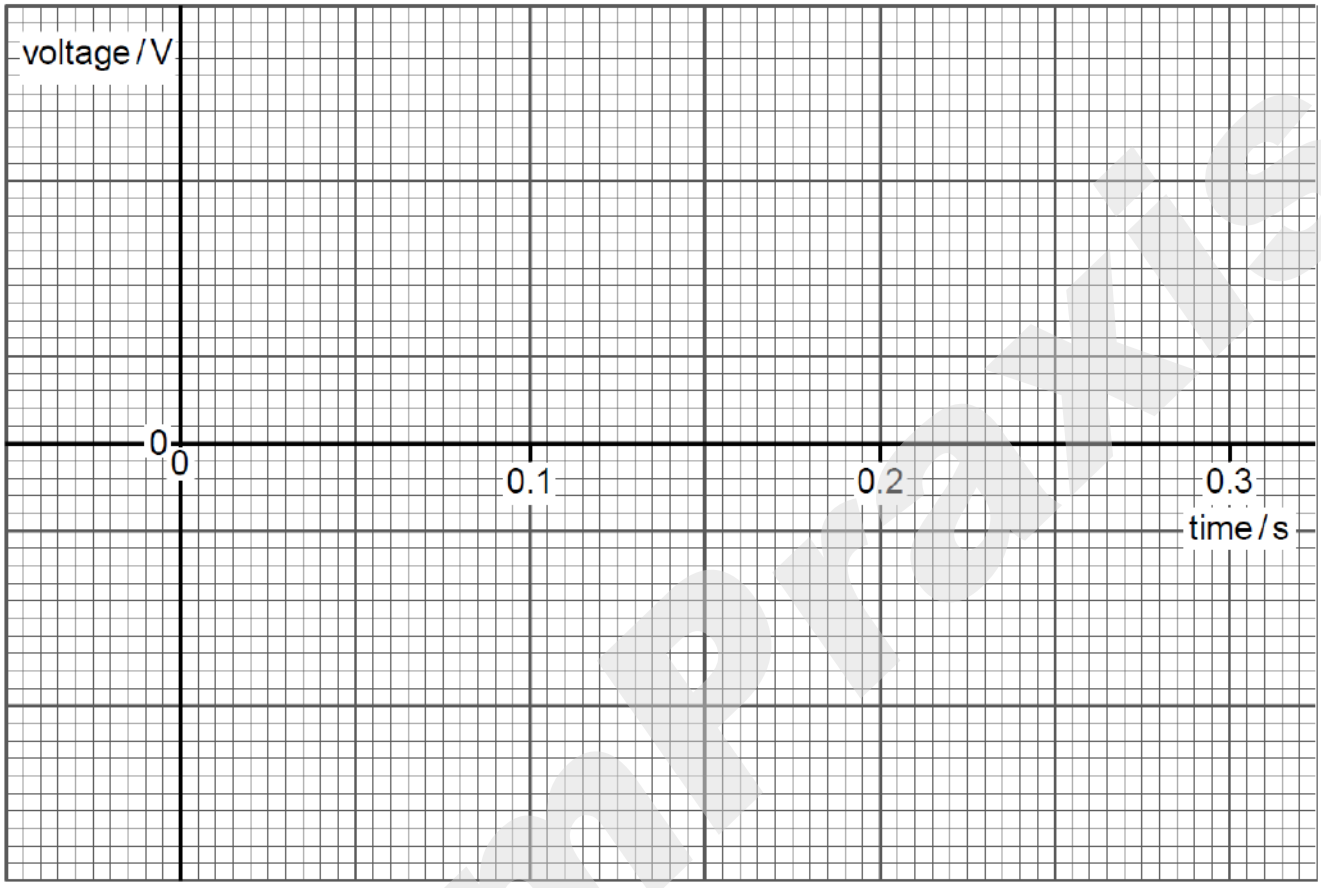


Fig. 8.2

On Fig. 8.2,

(i) mark suitable voltage values on the voltage axis,

(ii) draw a graph of the generator output.

[3]

(b) The generator shown in Fig. 8.1 works by electromagnetic induction.

Explain how this effect produces the output voltage.

.....

.....

.....

..... [3]

(c) State the energy changes that occur in the generator when it is producing output.

..... [2]

10 Fig. 10.1 shows a battery with an e.m.f of 12 V supplying power to two lamps.

The total power supplied is 150 W when both lamps are on.

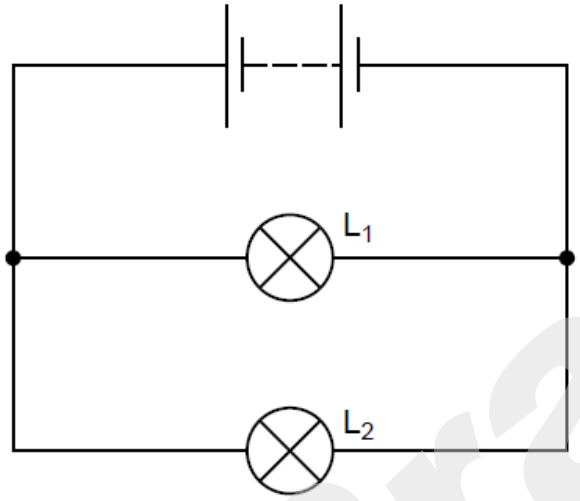


Fig. 10.1

(a) Calculate the current supplied by the battery when both lamps are on.

current = ... [2]

(b) The current in lamp L_2 is 5.0 A.

Calculate

(i) the current in lamp L_1,

current = ...

(ii) the power of lamp L_1,

power = ...

(iii) the resistance of lamp L_1.

resistance = ...

[6]

(IGCSE Physics Year 2004 May/June Paper 3-Set 1)

8 Fig. 8.1 shows a 240 V a.c. mains circuit to which a number of appliances are connected and switched on.

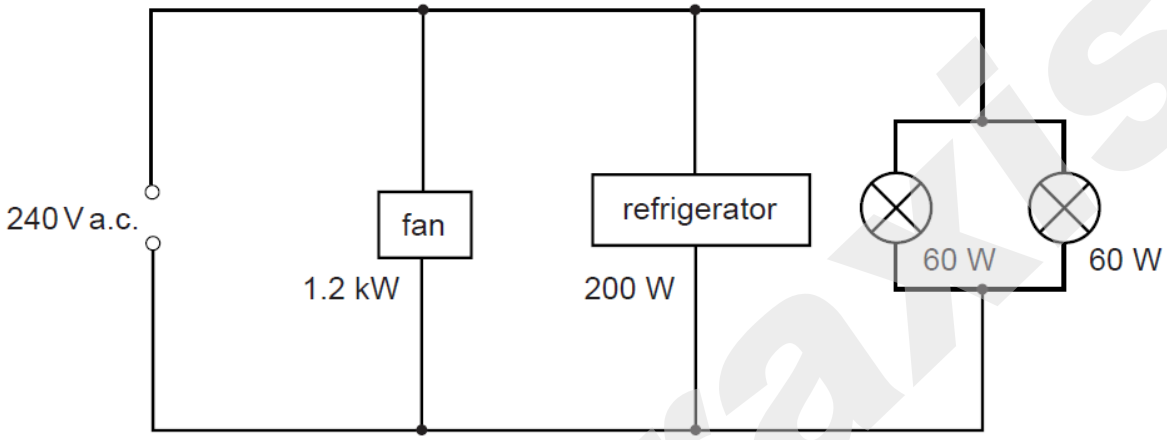


Fig. 8.1

(a) Calculate the power supplied to the circuit.

power = ...[1]

(b) The appliances are connected in parallel.

(i) Explain what connected *in parallel* means.

.....

.....

(ii) State two advantages of connecting the appliances in parallel rather than in series.

advantage 1 .....

advantage 2 .....

[3]

(c) Calculate

(i) the current in the refrigerator,

current = ...

(ii) the energy used by the fan in 3 hours,

energy = ...

(iii) the resistance of the filament of one lamp.

resistance = ...

[7]

9 Electromagnetic induction can be demonstrated using a solenoid, a magnet, a sensitive ammeter and connecting wire.

(a) In the space below, draw a labelled diagram of the apparatus set up to demonstrate electromagnetic induction. [2]

(b) State one way of using the apparatus to produce an induced current.

.....

.....[1]

(c) Explain why your method produces an induced current.

.....

.....

.....[2]

(d) Without changing the apparatus, state what must be done to produce

(i) an induced current in the opposite direction to the original current,

.....

.....

(ii) a larger induced current.

.....

.....

[2]

10 **(a)** Fig. 10.1 shows the faces of two ammeters. One has an analogue display and the other a digital display.

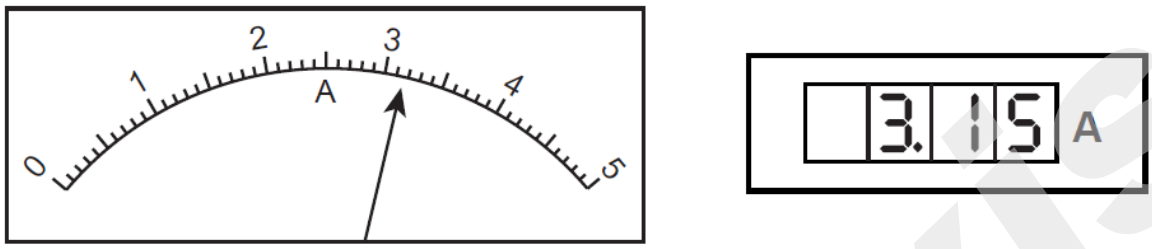


Fig. 10.1

State what is meant by the terms *analogue* and *digital*.

.....

.....

.....[2]

(b) **(i)** Name the components from which logic gates are made.

.....[1]

(ii) In the space below, draw the symbol for an AND gate.
Label the inputs and the output. [1]

(iii) Describe the action of an AND gate with two inputs. [2]

(IGCSE Physics Year 2004 Oct/Nov Paper 3-Set 1)

7 Fig. 7.1 shows a 12 V battery connected to a number of resistors.

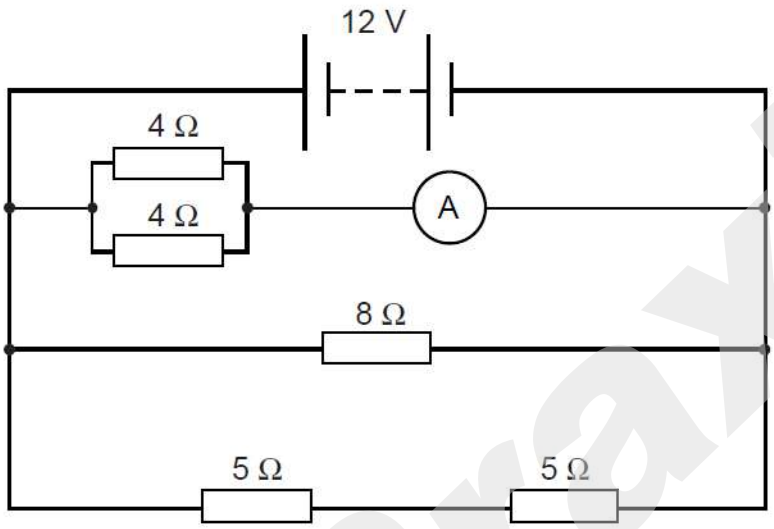


Fig. 7.1

(a) Calculate the current in the 8 Ω resistor.

current = ...[2]

(b) Calculate, for the resistors connected in the circuit, the combined resistance of

(i) the two 5 Ω resistors,

resistance = ...

(ii) the two 4 Ω resistors.

resistance = ...
[2]

(c) The total current in the two 4 Ω resistors is 6 A.
Calculate the total power dissipated in the two resistors.

power = ...[2]

(d) What will be the reading on a voltmeter connected across

(i) the two 4 Ω resistors,

reading = ...

(ii) one 5 Ω resistor?

reading = ...
[2]

(e) The 8 Ω resistor is made from a length of resistance wire of uniform cross-sectional area. State the effect on the resistance of the wire of using

(i) the same length of the same material with a greater cross-sectional area,

.....

(ii) a smaller length of the same material with the same cross-sectional area.

.....

[2]

9 **(a)** An engine on a model railway needs a 6 V a.c. supply. A mains supply of 240 V a.c. is available.

(i) In the space below, draw a labelled diagram of a transformer suitable for producing the required supply voltage.

(ii) Suggest suitable numbers of turns for the coils.

.....

.....

[4]

(b) The power needed for this model engine is 12 W. Calculate the current taken from the mains when just this engine is in use, assuming that the transformer is 100% efficient.

current = ...[2]

(c) Explain why transformers will only work when connected to an a.c. supply.

.....

.....

.....[2]

10 **(a)** **(i)** What is the function of a transistor when placed in an electrical circuit?

.....

(ii) Describe the action of a transistor.

.....

.....

.....

[3]

(b) **(i)** In the space below, draw the symbol for an OR gate. Label the inputs and the output.

[1]

(ii) Describe the action of an OR gate that has two inputs.

.....

.....

.....[2]

(IGCSE Physics Year 2005 May/June Paper 3-Set 1)

8 A student has a power supply, a resistor, a voltmeter, an ammeter and a variable resistor.

(a) The student obtains five sets of readings from which he determines an average value for the resistance of the resistor.

In the space below, draw a labelled diagram of a circuit that he could use.

[3]

(b) Describe how the circuit should be used to obtain the five sets of readings.

.....

.....

..... [2]

(c) Fig. 8.1 shows another circuit.

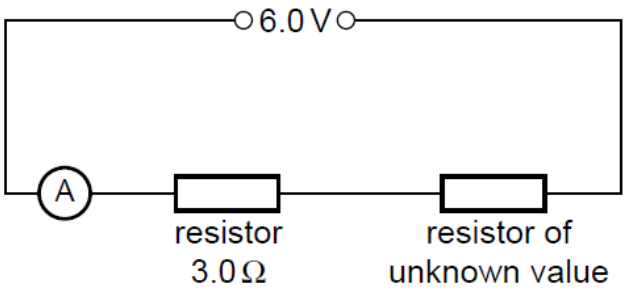


Fig. 8.1

When the circuit is switched on, the ammeter reads 0.50 A.

(i) Calculate the value of the unknown resistor.

resistance = ... [2]

(ii) Calculate the charge passing through the 3.0 Ω resistor in 120 s.

charge = ... [1]

(iii) Calculate the power dissipated in the 3.0 Ω resistor.

power = ... [2]

9 **(a)** Fig. 9.1 shows an a.c. supply connected to a resistor and a diode.

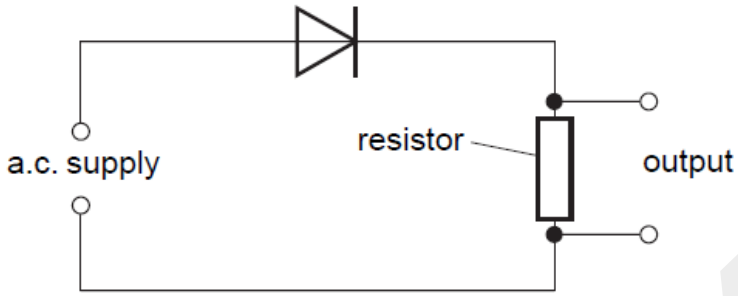


Fig. 9.1

(i) State the effect of fitting the diode in the circuit.

.....

..... [1]

(ii) On Fig. 9.2, sketch graphs to show the variation of the a.c. supply voltage and the output voltage with time.

Fig. 9.2

[2]

(b) **(i)** In the space below, draw the symbol for a NOT gate.

[1]

(ii) State the action of a NOT gate.

.....

.....

..... [2]

11 Fig. 11.1 shows a flexible wire hanging between two magnetic poles. The flexible wire is connected to a 12 V d.c. supply that is switched off.

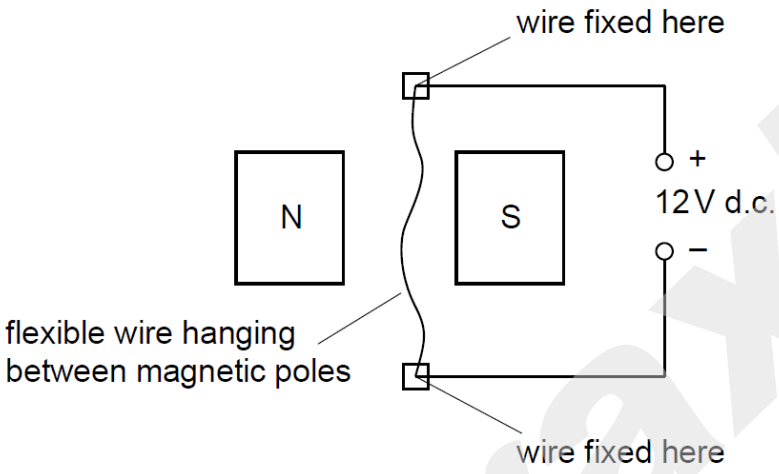


Fig. 11.1

(a) Explain why the wire moves when the supply is switched on.

.....

.....

..... [2]

(b) State the direction of the deflection of the wire.

.....

..... [2]

(c) When the wire first moves, energy is changed from one form to another. State these two forms of energy.

from ..... to ..... [1]

(d) Fig. 11.2 shows the flexible wire made into a rigid rectangular coil and mounted on an axle.

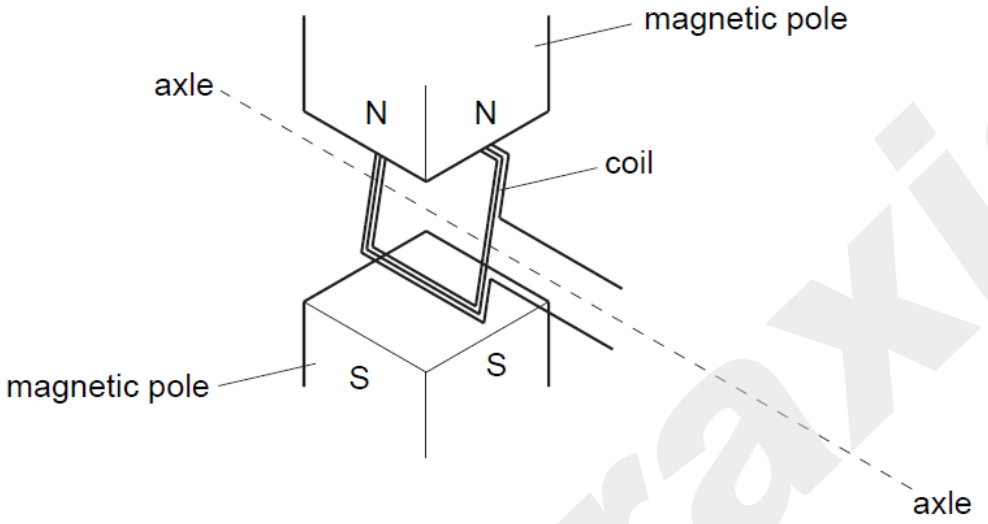


Fig. 11.2

(i) Add to the diagram an arrangement that will allow current to be fed into the coil whilst allowing the coil to turn continuously. Label the parts you have added. [1]

(ii) Briefly explain how your arrangement works.

.....

..... [2]

(IGCSE Physics Year 2005 Oct/Nov Paper 3-Set 1)

8 Fig. 8.1 shows a high-voltage supply connected across two metal plates.

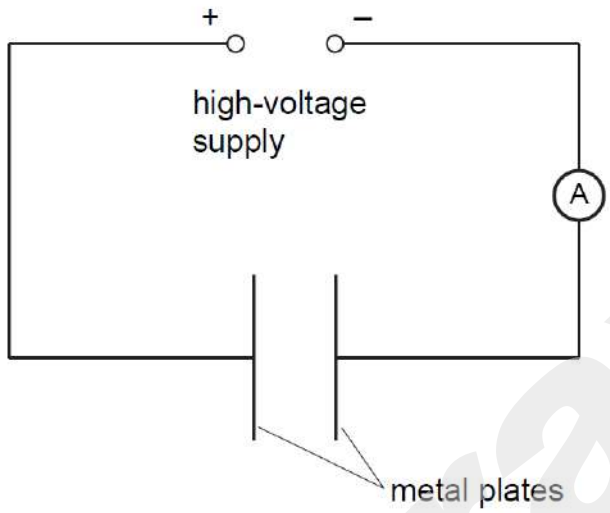


Fig. 8.1

When the supply is switched on, an electric field is present between the plates.

(a) Explain what is meant by an *electric field* .

..... [2]

(b) On Fig. 8.1, draw the electric field lines between the plates and indicate their direction by arrows. [2]

(c) The metal plates are now joined by a high-resistance wire. A charge of 0.060 C passes along the wire in 30 s.
Calculate the reading on the ammeter.

ammeter reading = ... [2]

(d) The potential difference of the supply is re-set to 1500 V and the ammeter reading changes to 0.0080 A. Calculate the energy supplied in 10 s. Show your working.

energy = ... [3]

9 **(a)** In the space provided, draw the symbol for a NOR gate. Label the inputs and the output.

[2]

(b) State whether the output of a NOR gate will be high (ON) or low (OFF) when

(i) one input is high and one input is low,

.....

(ii) both inputs are high.

.....

[1]

(c) Fig. 9.1 shows a digital circuit made from three NOT gates and one NAND gate.

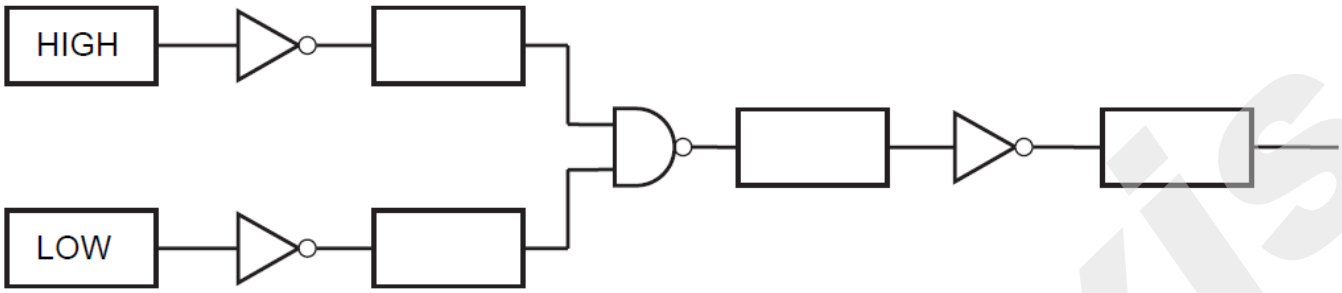


Fig. 9.1

(i) Write HIGH or LOW in each of the boxes on Fig. 9.1. [2]

(ii) State the effect on the output of changing both of the inputs.

.....

..... [1]

10 Fig. 10.1 shows the basic parts of a transformer.

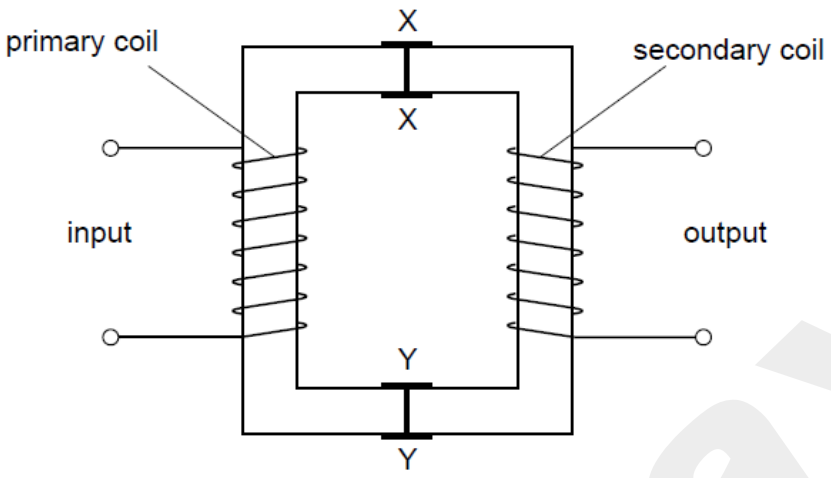


Fig. 10.1

(a) Use ideas of electromagnetic induction to explain how the input voltage is transformed into an output voltage. Use the three questions below to help you with your answer.

What happens in the primary coil?

.....

.....

.....

.....

What happens in the core?

.....

.....

What happens in the secondary coil?

.....

.....

..... [5]

(b) State what is needed to make the output voltage higher than the input voltage.

..... [1]

(c) The core of this transformer splits along XX and YY. Explain why the transformer would not work if the two halves of the core were separated by about 30 cm.

.....

..... [1]

(d) A 100% efficient transformer is used to step up the voltage of a supply from 100 V to 200 V. A resistor is connected to the output. The current in the primary coil is 0.4 A.

Calculate the current in the secondary coil.

current = ... [2]

(IGCSE Physics Year 2006 May/June Paper 3-Set 1)

8 Fig. 8.1 shows an electrical circuit.

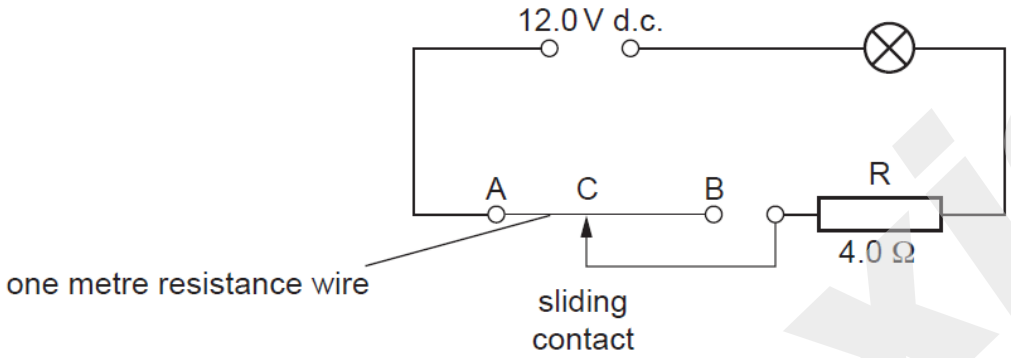


Fig. 8.1

The resistance of the lamp is 4.0 Ω when it is at its normal brightness.

(a) The lamp is rated at 6.0V, 9.0W.
Calculate the current in the lamp when it is at its normal brightness.

current = ...[2]

(b) The sliding contact C is moved to A. The lamp lights at its normal brightness.
Calculate

(i) the total circuit resistance,

resistance = ...[1]

(ii) the potential difference across the 4.0 Ω resistor R.

potential difference = ...[1]

(c) The sliding contact C is moved from A to B.

(i) Describe any change that occurs in the brightness of the lamp.

.....[1]

(ii) Explain your answer to **(i)**.

.....

.....[2]

(d) The 1 m wire between A and B, as shown in Fig. 8.1, has a resistance of 2.0 Ω. Calculate the resistance between A and B when

(i) the 1 m length is replaced by a 2 m length of the same wire,

resistance = ...[1]

(ii) the 1 m length is replaced by a 1 m length of a wire of the same material but of only half the cross-sectional area.

resistance = ...[1]

9 A transformer is needed to step down a 240 V a.c. supply to a 12 V a.c. output.

(a) In the space below, draw a labelled diagram of a suitable transformer. [3]

(b) Explain

(i) why the transformer only works on a.c.,

.....

.....[1]

(ii) how the input voltage is changed to an output voltage.

.....

.....

.....[2]

(c) The output current is 1.5 A.

Calculate

(i) the power output,

power = ...[1]

(ii) the energy output in 30 s.

energy = ...[1]

10 **(a)** Fig. 10.1 shows a positively charged plastic rod, a metal plate resting on an insulator, and a lead connected to earth.

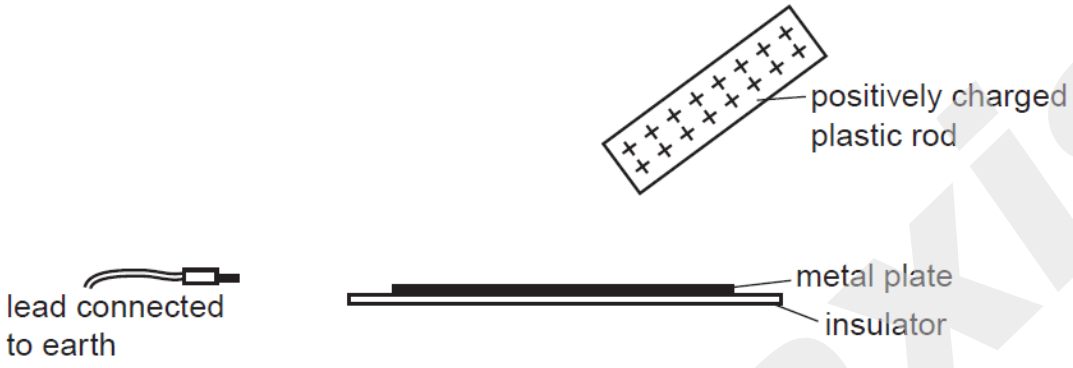


Fig. 10.1

Describe how the metal plate may be charged by induction.

.....

.....

.....[3]

(b) An electrostatic generator sets up a current of 20 mA in a circuit.

Calculate

(i) the charge flowing through the circuit in 15 s,

charge = ...

(ii) the potential difference across a 10 kΩ resistor in the circuit.

potential difference = ...
[3]

(IGCSE Physics Year 2006 Oct/Nov Paper 3-Set 1)

8 Fig. 8.1 shows a low-voltage lighting circuit.

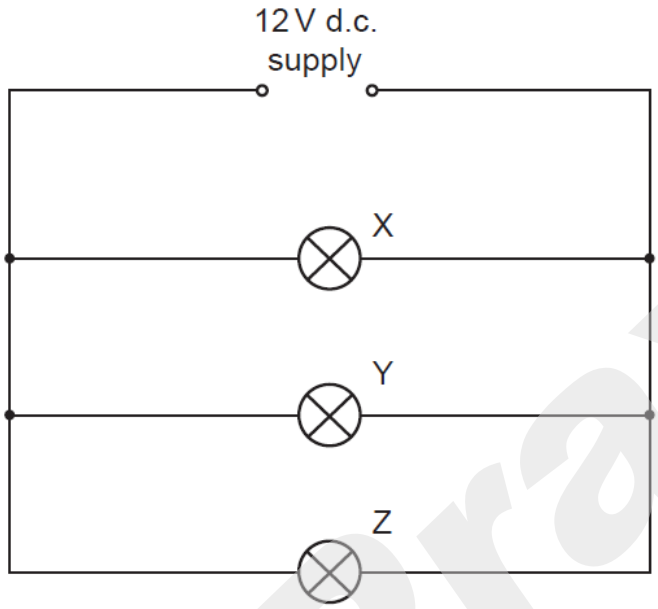


Fig. 8.1

(a) On Fig. 8.1, indicate with a dot and the letter S, a point in the circuit where a switch could be placed that would turn off lamps Y and Z at the same time but would leave lamp X still lit. [1]

(b) **(i)** In the space below, draw the circuit symbol for a component that would vary the brightness of lamp X.

(ii) On Fig. 8.1, mark with a dot and the letter R where this component should be placed.

[2]

(c) Calculate the current in lamp Y.

current = ...[2]

(d) The current in lamp Z is 3.0 A. Calculate the resistance of this lamp.

resistance = ...[2]

(e) The lamp Y is removed.

(i) Why do lamps X and Z still work normally?

.....

.....

(ii) The current in lamp X is 1.0 A. Calculate the current supplied by the battery with lamp Y removed.

current = ...
[2]

10 Fig. 10.1 shows a circuit that is used to switch on a lamp automatically when it starts to go dark.

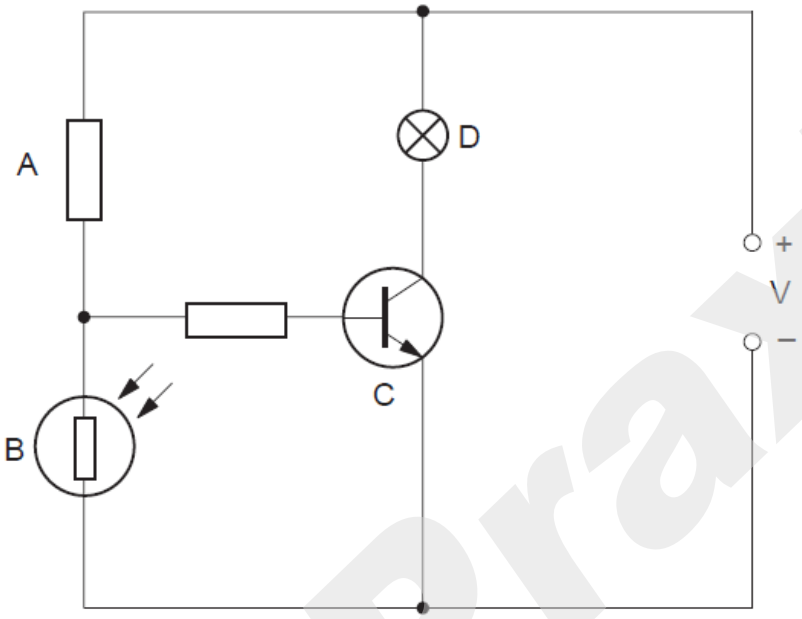


Fig. 10.1

(a) Write down the names of the components labelled A, B, C and D.

A ..... B .....

C ..... D ..... [2]

(b) Which of the four components A, B, C or D acts as a switch?

.....[1]

(c) Explain why the lamp comes on as it goes dark.

.....

.....

.....

.....[3]

(IGCSE Physics Year 2007 May/June Paper 3-Set 1)

8 Fig. 8.1 shows part of a low-voltage lighting circuit containing five identical lamps.

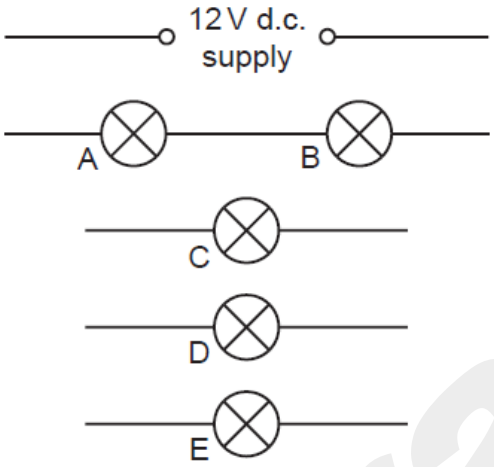


Fig. 8.1

(a) Complete the circuit, by the addition of components as necessary, so that

(i) the total current from the supply can be measured,

(ii) the brightness of lamp E only can be varied,

(iii) lamps C and D may be switched on and off together whilst lamps A, B and E remain on. [4]

(b) All five lamps are marked 12V, 36W. Assume that the resistance of each lamp is the same fixed value regardless of how it is connected in the circuit.

Calculate

(i) the current in one lamp when operating at normal brightness,

current = ... [1]

(ii) the resistance of one lamp when operating at normal brightness,

resistance = ... [1]

(iii) the combined resistance of two lamps connected in parallel with the 12 V supply,

resistance = ... [1]

(iv) the energy used by one lamp in 30 s when operating at normal brightness.

energy = ... [1]

(c) The whole circuit is switched on. Explain why the brightness of lamps A and B is much less than that of one lamp operating at normal brightness.

.....

.....

..... [2]

[Total: 10]

9 Fig. 9.1 is a sketch of some apparatus, found in a Science museum, which was once used to show how electrical energy can be converted into kinetic energy.

When the switch is closed the wheel starts to turn.

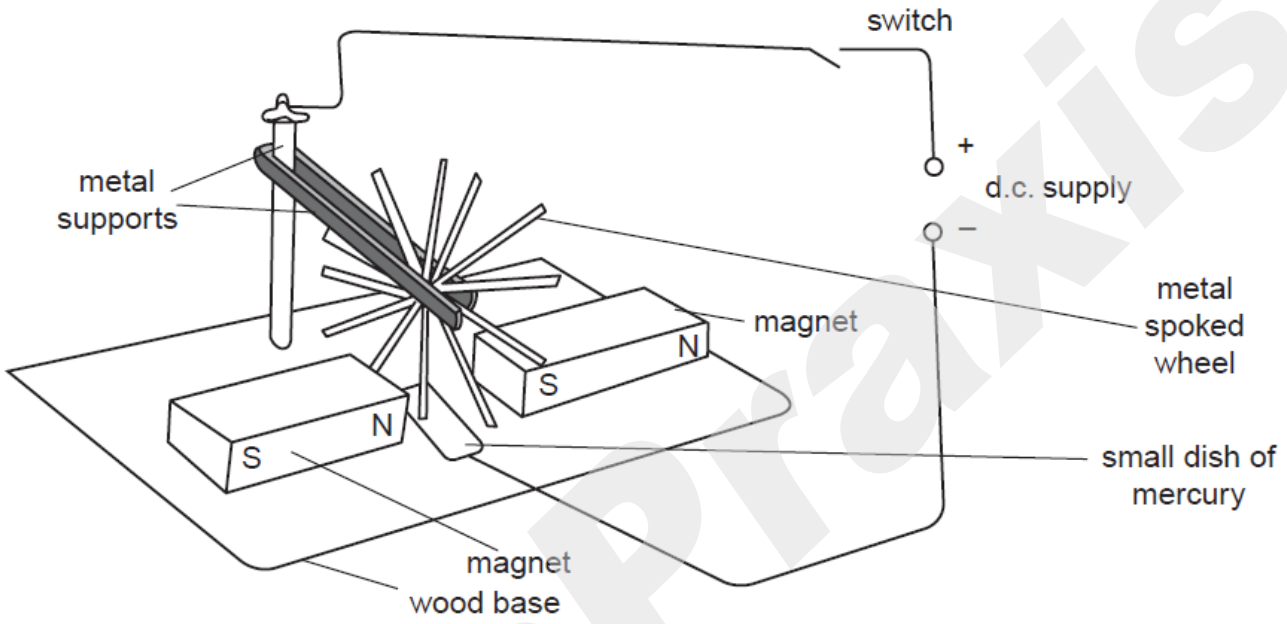


Fig. 9.1

(a) Explain why the wheel turns when the switch is closed.

.....

.....

.....

..... [2]

(b) On Fig. 9.1, draw an arrow to show the direction of rotation of the wheel. [1]

(c) The d.c. motor is another way to convert electrical energy into kinetic energy.

In the space below, draw a labelled diagram of a d.c. motor.

[3]

(d) Describe how the split-ring commutator on an electric motor works.

.....

.....

.....

..... [2]

10 Fig. 10.1 shows a circuit based on a transistor and a thermistor.

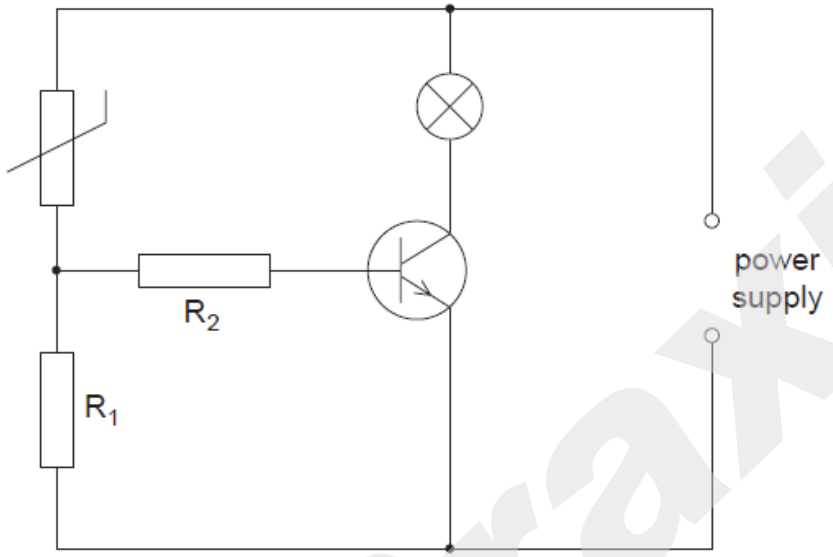


Fig. 10.1

(a) Describe the action of the thermistor in this circuit.

.....

.....

.....

..... [3]

(b) State and explain how the circuit may be modified so that the lamp switches on at a different temperature.

.....

.....

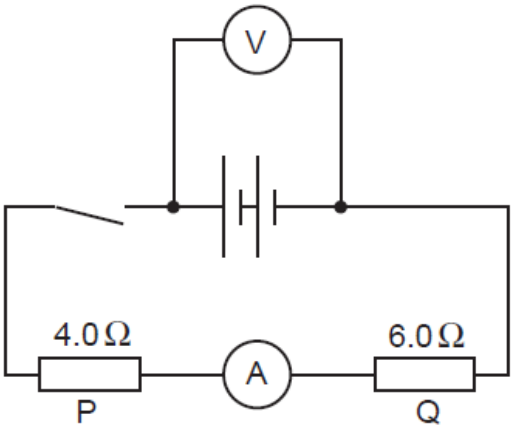
..... [2]

(c) State one practical use of this circuit.

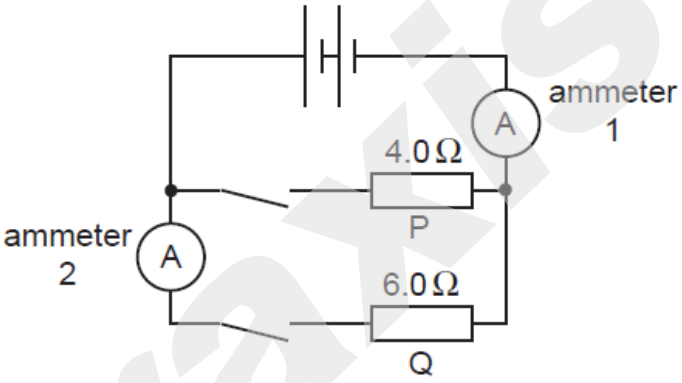
..... [1]

(IGCSE Physics Year 2007 Oct/Nov Paper 3-Set 1)

8 Fig. 8.1 shows two electrical circuits.



circuit 1



circuit 2

The batteries in circuit 1 and circuit 2 are identical.

Fig. 8.1

(a) Put ticks in the table below to describe the connections of the two resistors P and Q.

	series	parallel
circuit 1		
circuit 2		

[1]

(b) The resistors P and Q are used as small electrical heaters.

State two advantages of connecting them as shown in circuit 2.

advantage 1 .....

advantage 2 ..... [2]

(c) In circuit 1, the ammeter reads 1.2 A when the switch is closed.

Calculate the reading of the voltmeter in this circuit.

voltmeter reading = ... [2]

(d) The two switches in circuit 2 are closed. Calculate the combined resistance of the two resistors in this circuit.

combined resistance = ... [2]

(e) When the switches are closed in circuit 2, ammeter 1 reads 5 A and ammeter 2 reads 2 A.

Calculate

(i) the current in resistor P,

current = ... [1]

(ii) the power supplied to resistor Q,

power = ... [1]

(iii) the energy transformed in resistor Q in 300 s.

energy = ... [1]

[Total: 10]

9 Electromagnetic induction may be demonstrated using a magnet, a solenoid and other necessary apparatus.

(a) Explain what is meant by *electromagnetic induction*.

.....

.....

.....

..... [2]

(b) In the space below, draw a labelled diagram of the apparatus set up so that electromagnetic induction may be demonstrated. [2]

(c) Describe how you would use the apparatus to demonstrate electromagnetic induction.

.....

.....

.....

..... [2]

(d) State two ways of increasing the magnitude of the induced e.m.f. in this experiment.

1. .....

.....

2. .....

..... [2]

[Total: 8]

10 **(a)** Fig. 10.1 shows an AND gate with two inputs A and B and one output.

Fig. 10.1

State the output when

(i) A is high and B is low,

..... [1]

(ii) both A and B are low.

..... [1]

(b) An electrical thermometer in a greenhouse gives a low output if the temperature is too low.

A humidity sensor in the same greenhouse gives a high output if the humidity in the greenhouse is too high.

An alarm sounds when both the temperature is too low and the humidity is too high.

(i) Complete the diagram below to show how a NOT gate and an AND gate may be used to provide the required output to the alarm. [2]

(ii) On your diagram, use either 'high' or 'low' to indicate the level of the inputs and outputs of both gates when the alarm sounds. [2]

[Total: 6]

(IGCSE Physics Year 2008 May/June Paper 3-Set 1)

8 Fig. 8.1 is the plan of a small apartment that has four lamps as shown.

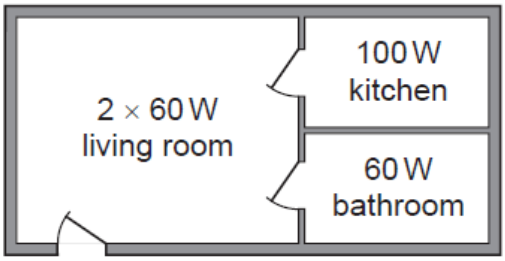


Fig. 8.1

Power for the lamps is supplied at 200 V a.c. and the lamps are all in parallel.

(a) In the space below, draw a lighting circuit diagram so that there is one switch for each room and one master switch that will turn off all the lamps. Label the lamps as 60 W or 100 W.

[3]

(b) The 100W lamp is switched on. Calculate

(i) the current in the lamp,

current = ... [2]

(ii) the charge passing through the lamp in one minute.

charge = ... [2]

(c) The three 60W lamps are replaced by three energy-saving ones, that give the same light output but are rated at only 15W each.

Calculate

(i) the total reduction in power,

reduction in power = ... [1]

(ii) the energy saved when the lamps are lit for one hour.

energy saved = ... [2]

[Total: 10]

9 Fig. 9.1 shows apparatus used to investigate electromagnetic effects around straight wires.

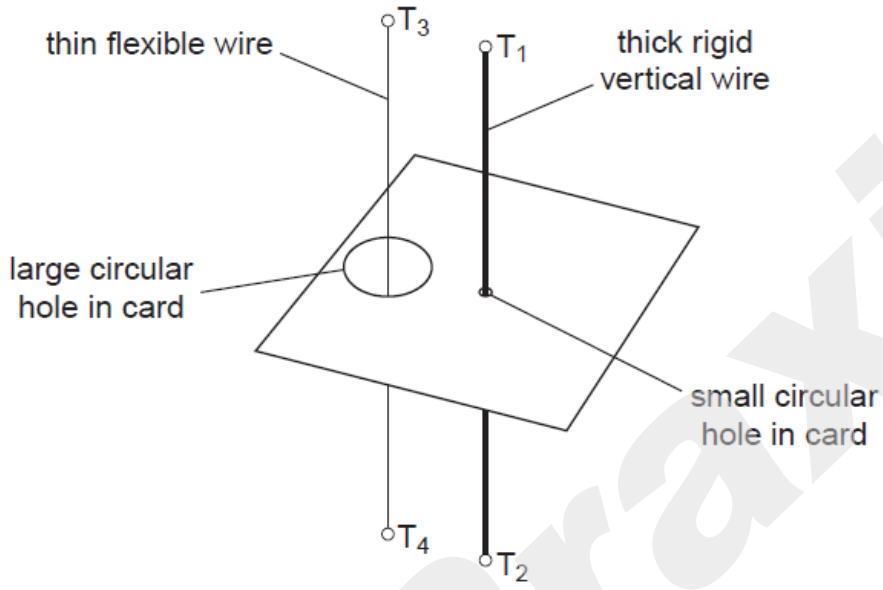


Fig. 9.1

Fig. 9.2 is a view looking down on the apparatus shown in Fig. 9.1.

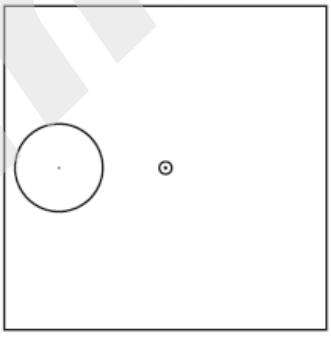


Fig. 9.2

(a) A battery is connected to T_1 and T_2 so that there is a current vertically down the thick wire.

On Fig. 9.2, draw three magnetic field lines and indicate, with arrows, the direction of all three. [2]

(b) Using a variable resistor, the p.d. between terminals T_1 and T_2 is gradually reduced.

State the effect, if any, that this will have on

(i) the strength of the magnetic field, ... [1]

(ii) the direction of the magnetic field. ..... [1]

(c) The battery is now connected to terminals T_3 and T_4, as well as to terminals T_1 and T_2, so that there is a current down both wires. This causes the flexible wire to move.

(i) Explain why the flexible wire moves.

.....

.....

.....

..... [2]

(ii) State the direction of the movement of the flexible wire.

..... [1]

(iii) The battery is replaced by one that delivers a smaller current.

State the effect that this will have on the force acting on the flexible wire.

.....

..... [1]

[Total: 8]

10 **(a)** In the space below, draw the symbol for a NOR gate.

[1]

(b) Describe the action of a NOR gate in terms of its inputs and output.

.....

.....

.....

.....

..... [2]

(c) A chemical process requires heating at low pressure to work correctly.

When the heater is working, the output of a temperature sensor is high.

When the pressure is low enough, a pressure sensor has a low output.

Both outputs are fed into a NOR gate. A high output from the gate switches on an indicator lamp.

(i) Explain why the indicator lamp is off when the process is working correctly.

.....

.....

..... [1]

(ii) State whether the lamp is on or off in the following situations.

1. The pressure is low enough, but the heater stops working. .....
2. The heater is working, but the pressure rises too high. ..... [2]

[Total: 6]

(IGCSE Physics Year 2008 Oct/Nov Paper 3-Set 1)

8 Fig. 8.1 shows a car battery being charged from a 200 V a.c. mains supply.

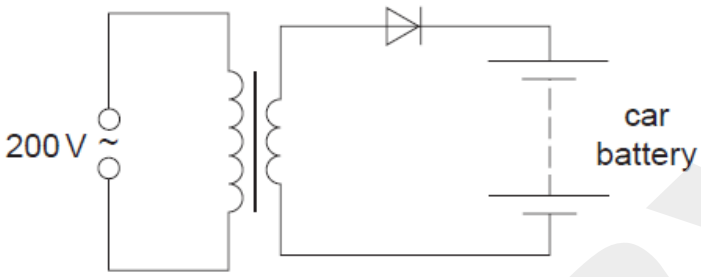


Fig. 8.1

(a) State the function of the diode.

.....

..... [1]

(b) The average charging current is 2.0 A and the battery takes 12 hours to charge fully.

Calculate the charge that the battery stores when fully charged.

charge stored ..... [2]

(c) The battery has an electromotive force (e.m.f.) of 12V and, when connected to a circuit, supplies energy to the circuit components.

State what is meant by an *electromotive force of 12V*.

.....

.....

..... [2]

(d) (i) In the space below, draw a circuit diagram to show how two 6.0V lamps should be connected to a 12V battery so that both lamps glow with normal brightness. [1]

(ii) The power of each lamp is 8.0W. Calculate the current in the circuit.

current = ... [2]

(iii) Calculate the energy used by the two lamps when both are lit for one hour.

energy = ... [2]

[Total: 10]

9 Fig. 9.1 is a block diagram of an electrical energy supply system, using the output of a coal-fired power station.

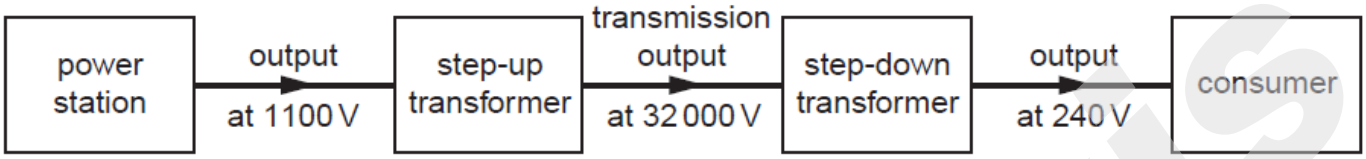


Fig. 9.1

(a) Suggest **one** possible way of storing surplus energy when the demand from the consumers falls below the output of the power station.

.....

..... [1]

(b) State why electrical energy is transmitted at high voltage.

..... [1]

(c) A transmission cable of resistance R carries a current I. Write down a formula that gives the power loss in the cable in terms of R and I.

..... [1]

(d) The step-up transformer has 1200 turns on the primary coil. Using the values in Fig. 9.1, calculate the number of turns on its secondary coil. Assume that the transformer has no energy losses.

number of turns = ... [2]

(e) The input to the step-up transformer is 800 kW.

Using the values in Fig. 9.1, calculate the current in the transmission cables, assuming that the transformer is 100% efficient.

current = ... [3]

[Total: 8]

10 Fig. 10.1 shows a circuit for a warning lamp that comes on when the external light intensity falls below a pre-set level.

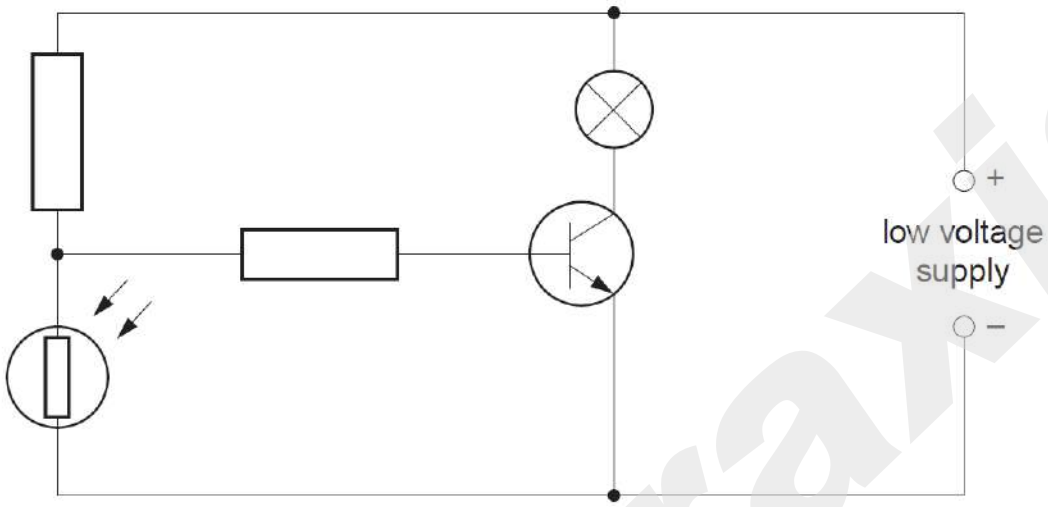


Fig. 10.1

(a) On Fig. 10.1, label

(i) with the letter X the component that detects the change in external light intensity,

(ii) with the letter Y the lamp,

(iii) with the letter Z the component that switches the lamp on and off.

[3]

(b) Describe how the circuit works as the external light intensity decreases and the lamp comes on.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 6]

11 Fig. 11.1 shows the basic design of the tube of a cathode ray oscilloscope (CRO).

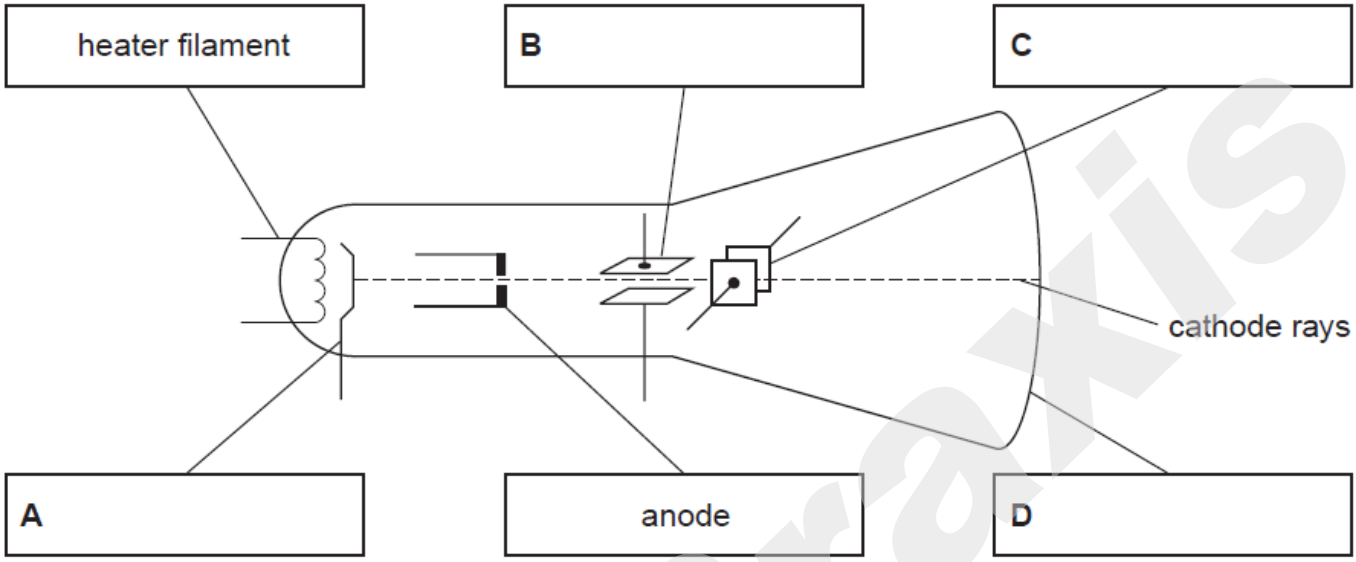


Fig. 11.1

(a) On Fig. 11.1, write the names of parts **A**, **B**, **C** and **D** in the boxes provided. [2]

(b) State the function of:

part **A**, ...

.....

part **B**. .....

..... [2]

(c) A varying p.d. from a 12V supply is connected to a CRO, so that the waveform of the supply is shown on the screen.

To which of the components in Fig. 11.1

(i) is the 12V supply connected,

..... [1]

(ii) is the time-base connected?

..... [1]

[Total: 6]

(IGCSE Physics Year 2009 May/June Paper 3-Set 1)

9 **(a)** Fig. 9.1 shows an a.c. supply connected in series to a diode and a resistor.

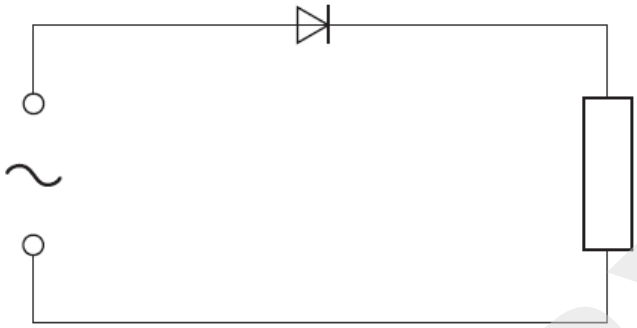


Fig. 9.1

On the axes of Fig. 9.2, draw a graph showing the variation of the current in the resistor. [1]

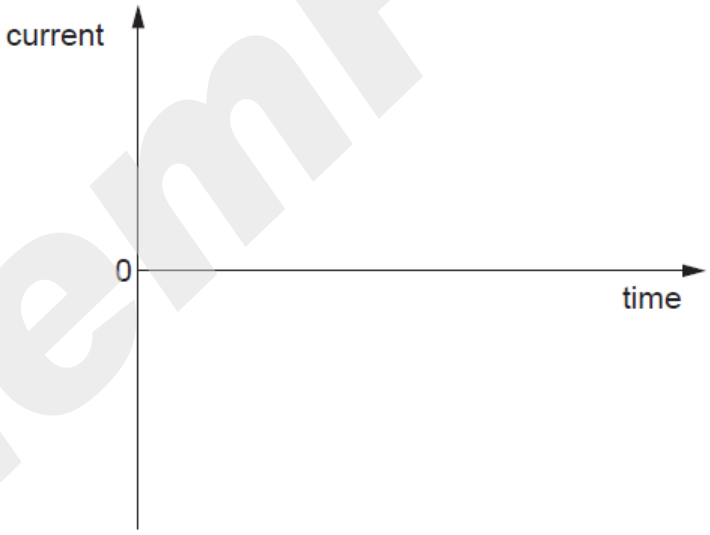


Fig. 9.2

(b) Fig. 9.3 shows four attempts, **A**, **B**, **C** and **D**, to connect a circuit known as a bridge rectifier.

The circuit is connected to a 12V a.c. supply.

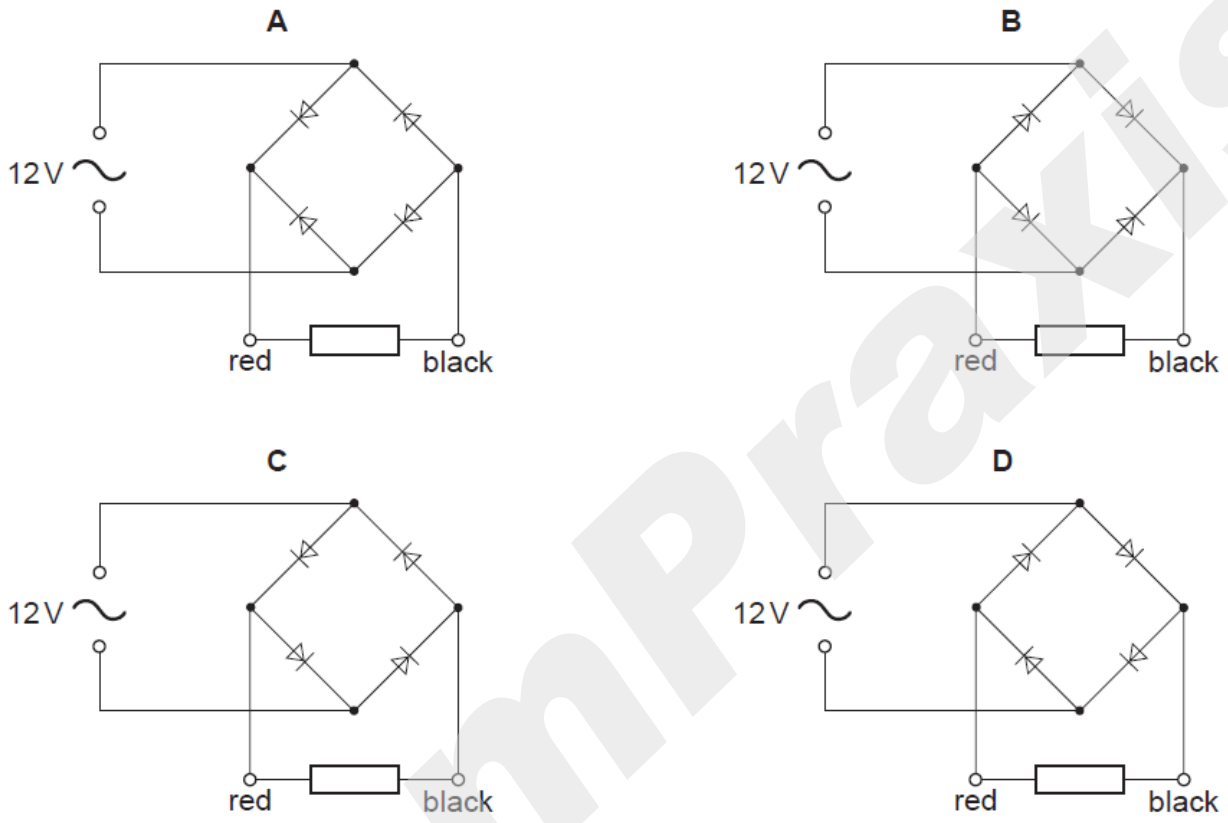


Fig. 9.3

(i) In which circuit will the direction of the conventional current in the resistor always be from red to black?

..... [1]

(ii) On the circuit you chose in **(b)(i)**, clearly indicate with arrows the path of the conventional current in the circuit when the upper terminal of the a.c. supply is positive with respect to the lower terminal. [2]

[Total: 4]

10 The circuit shown in Fig. 10.1 uses a 12V battery.

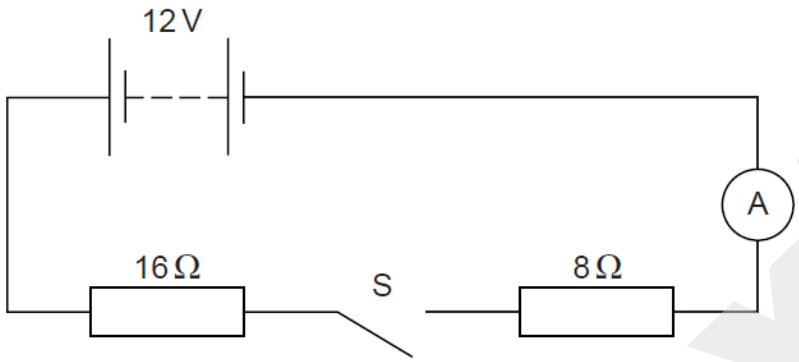


Fig. 10.1

(a) Switch S is open, as shown in Fig. 10.1.

State the value of

(i) the reading on the ammeter,

reading = ... [1]

(ii) the potential difference (p.d.) across S.

p.d. = ... [1]

(b) Switch S is now closed.

(i) Calculate the current in the ammeter.

current = ... [2]

(ii) Calculate the p.d. across the 8 Ω resistor.

p.d. = ... [2]

(c) The two resistors are now connected in parallel.

Calculate the new reading on the ammeter when S is closed, stating clearly any equations that you use.

reading = ... [4]

[Total: 10]

(IGCSE Physics Year 2009 Oct/Nov Paper 3-Set 1)

10 Alternating current electricity is delivered at 22 000 V to a pair of transmission lines. The transmission lines carry the electricity to the customer at the receiving end, where the potential difference is *V*. This is shown in Fig. 10.1. Each transmission line has a resistance of 3 Ω.

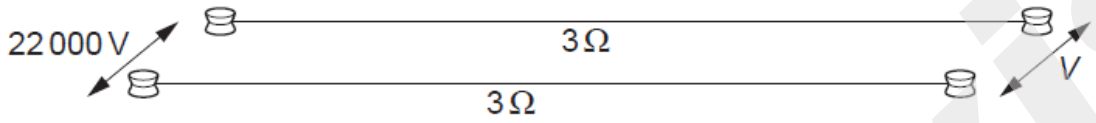


Fig. 10.1

(a) The a.c. generator actually generates at a much lower voltage than 22 000 V.

(i) Suggest how the voltage is increased to 22 000 V.

..... [1]

(ii) State one advantage of delivering electrical energy at high voltage.

..... [1]

(b) The power delivered by the generator is 55 kW. Calculate the current in the transmission lines.

current = ... [2]

(c) Calculate the rate of loss of energy from one of the 3 Ω transmission lines.

rate of energy loss = ... [2]

(d) Calculate the voltage drop across one of the transmission lines.

voltage drop = ... [2]

(e) Calculate the potential difference V at the receiving end of the transmission lines.

V = ... [2]

[Total: 10]

11 Fig. 11.1 is a schematic diagram of an electronic circuit controlling a lamp.

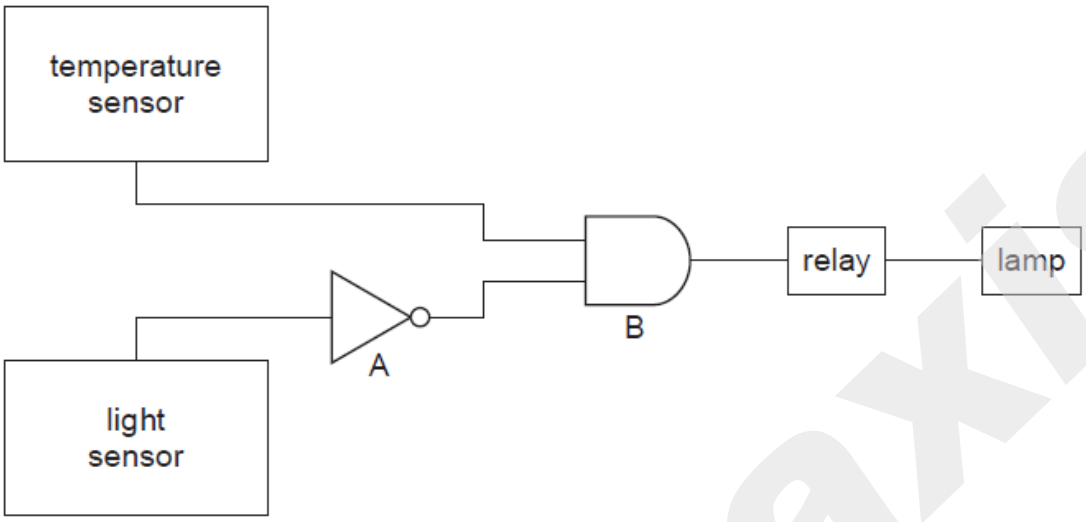


Fig. 11.1

(a) State the names of the logic gates A and B.

A ..... B ..... [2]

(b) The output of the temperature sensor is high (logic 1) when it detects raised temperature. The output of the light sensor is high (logic 1) when it detects raised light levels.

State the outputs of A and B when the surroundings are

(i) dark and cold,

output of A = ...

output of B = ... [1]

(ii) dark and warm,

output of A = ...

output of B = ... [1]

(iii) bright and warm.

output of A = ...

output of B = ... [1]

(c) **(i)** Suggest why B is connected to a relay, rather than directly to the lamp.

..... [1]

(ii) The relay switches on when its input is high. In which of the three combinations in **(b)** will the lamp light up?

..... [1]

(iii) Suggest a practical use for this circuit.

..... [1]

[Total: 8]

(IGCSE Physics Year 2009 May/June Paper 3-Set 2)

9 **(a)** Fig. 9.1 shows an a.c. supply connected in series to a diode and a resistor.

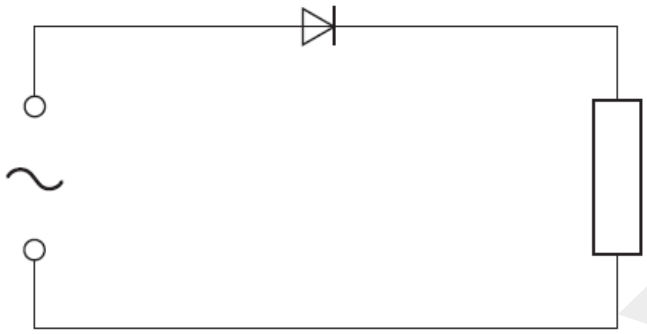


Fig. 9.1

On the axes of Fig. 9.2, draw a graph showing the variation of the current in the resistor. [1]

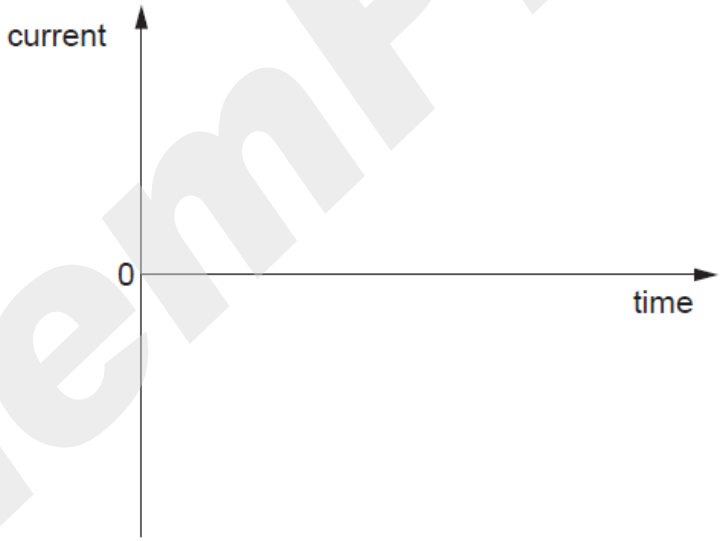


Fig. 9.2

(b) Fig. 9.3 shows four attempts, **A**, **B**, **C** and **D**, to connect a circuit known as a bridge rectifier.

The circuit is connected to a 12V a.c. supply.

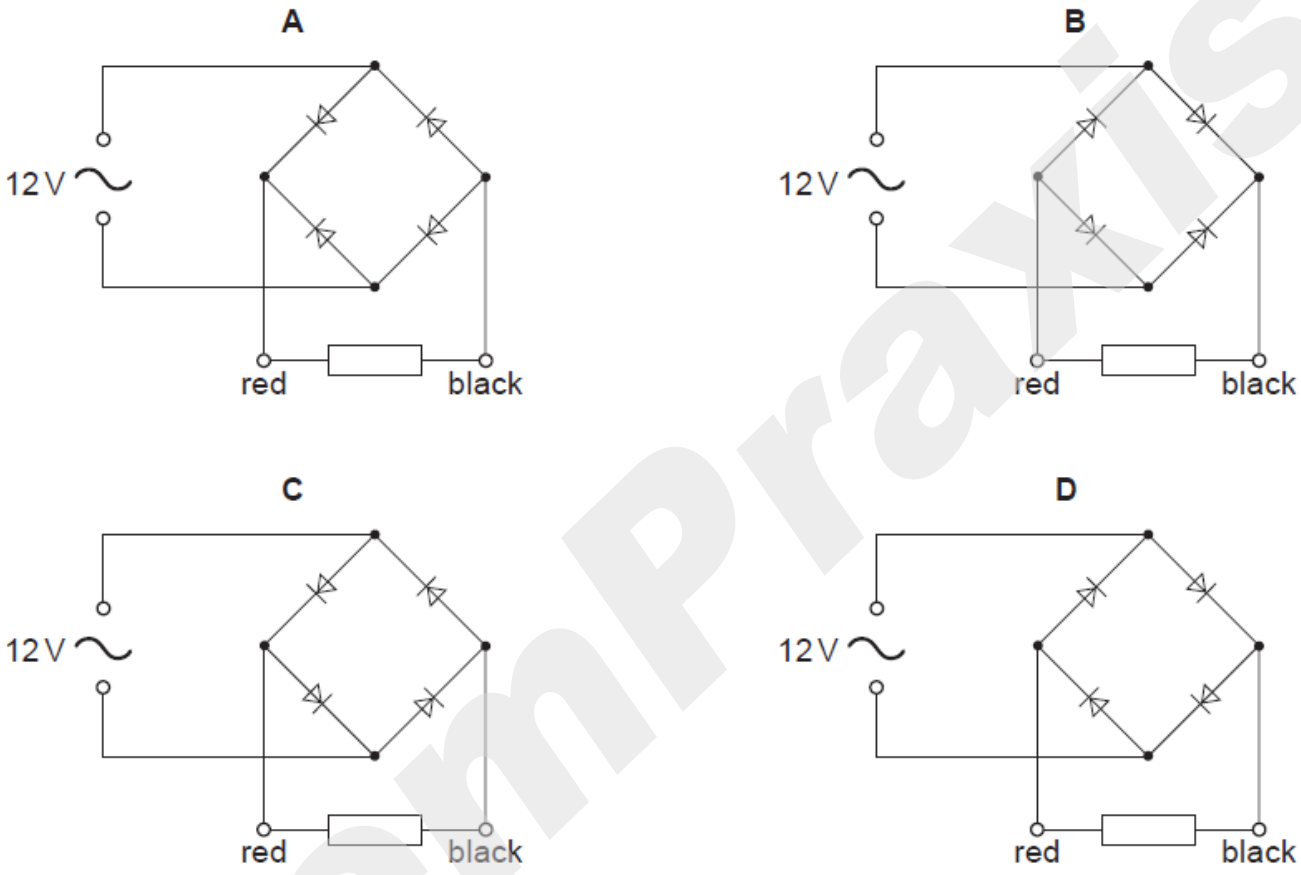


Fig. 9.3

(i) In which circuit will the direction of the conventional current in the resistor always be from red to black?

..... [1]

(ii) On the circuit you chose in **(b)(i)**, clearly indicate with arrows the path of the conventional current through the circuit when the upper terminal of the a.c. supply is positive with respect to the lower terminal. [2]

[Total: 4]

10 The circuit shown in Fig. 10.1 uses a 12V battery. A and B are identical lamps, each designed to work from a 6V supply.

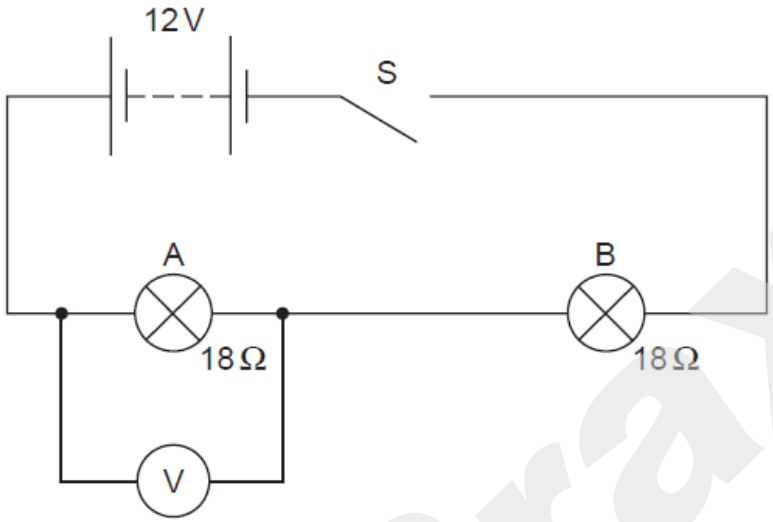


Fig. 10.1

(a) Switch S is open, as shown in Fig. 10.1.

(i) State the value of

1. the potential difference (p.d.) across S,

p.d. = ... [1]

2. the reading on the voltmeter.

reading = ... [1]

(ii) Comment on the brightness of the two lamps.

..... [1]

(b) Switch S is now closed.

(i) State the new reading on the voltmeter.

new reading = ... [1]

(ii) Comment on the brightness of the two lamps.

..... [1]

(iii) Under these conditions, each lamp has a resistance of 18 Ω.

Calculate the current in each lamp.

current = ... [3]

(c) With switch S open, lamp B is connected in parallel with lamp A. With no current, each lamp has a resistance of 1.8 Ω.

(i) Calculate the value of the combined resistance of A and B.

combined resistance = ... [2]

(ii) State why it would not be wise to close S when A and B are connected in parallel.

.....

..... [1]

[Total: 11]