Name..... Set..... Don.....

Winchester College
Physics

3rd year Revision Test

Electromagnetism

Common Time 201[redacted]

Answer all the questions.
Total 43 marks.

Allow 40 minutes.

Remember to show your working where applicable.
Calculators are allowed.

For Examiner's Use

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

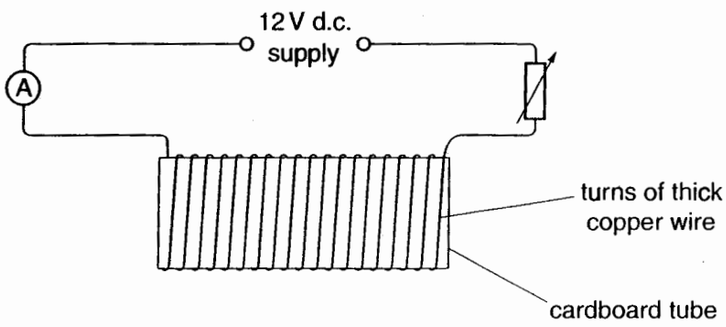


Fig. 7.1

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]

For Examiner's Use

(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]

[Turn over

For Examiner's Use

2 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.

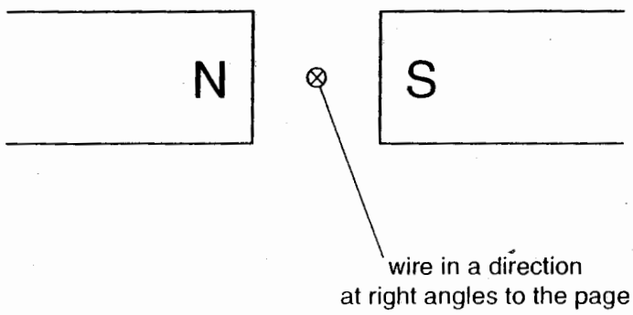


Fig. 8.1

(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]

For Examiner's Use

3 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]

For Examiner's Use

4 Fig. 9.1 shows a beam of electrons, two charged plates and a screen. These components are inside an electron tube, the outline of which is not shown.

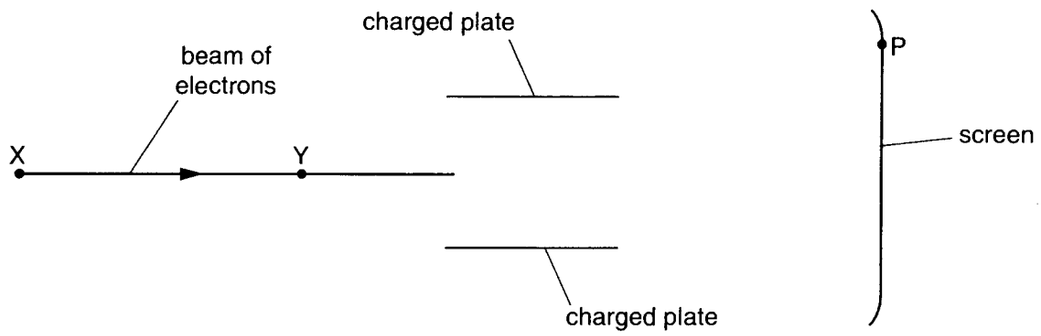


Fig. 9.1

The beam of electrons hits the screen at the point P.

(a) On Fig. 9.1,

(i) complete the path of the electron beam,

(ii) mark the charges on both plates,

(iii) mark with an arrow and the letter C the direction of the conventional current in the electron beam.

[4]

(b) In this electron tube, the electrons are produced at X and are accelerated towards Y. In the space below, draw a labelled diagram of the components needed to produce and accelerate the electrons. [4]

For Examiner's Use

5 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.

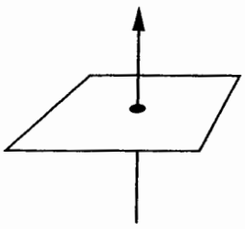
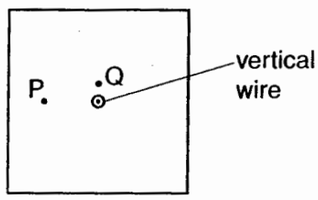


Fig. 10.1



view from above the card

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.

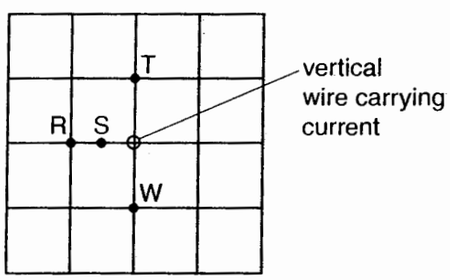


Fig. 10.3

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]

Name..... Set..... Don.....

Winchester College
Physics

3rd year Revision Test

Thermal and Material Physics

Common Time 2010

Answer all the questions.
Total 40 marks.

Allow 40 minutes.

Remember to show your working where applicable.
Calculators are allowed.

For Examiner's Use

1. Fig. 1 shows a diver 50 m below the surface of the water.

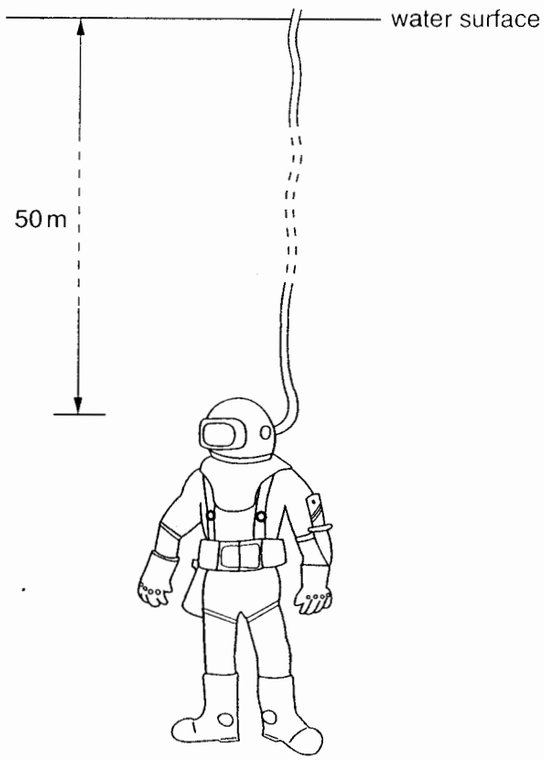


Fig. 1

The density of water is 1000 kg/m^3 and the acceleration of free fall is 10 m/s^2. Calculate the pressure that the water exerts on the diver.

pressure = ... [3]

2. Fig. 2 shows a way of indicating the positions and direction of movement of some molecules in a gas at one instant.

For Examiner's Use

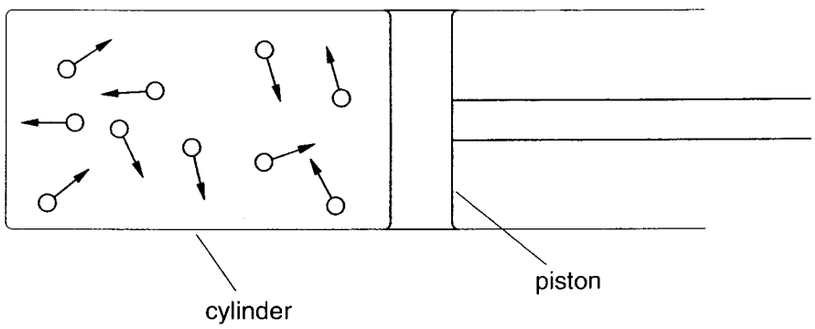


Fig. 2

(a) **(i)** Describe the movement of the molecules.

..... [1]

(ii) Explain how the molecules exert a pressure on the container walls.

.....

..... [1]

(b) When the gas in the cylinder is heated, it pushes the piston further out of the cylinder.

State what happens to

(i) the average spacing of the molecules,

..... [1]

(ii) the average speed of the molecules.

..... [1]

(c) The gas shown in Fig. 2 is changed into a liquid and then into a solid by cooling.

Compare the gaseous and solid states in terms of

(i) the movement of the molecules,

.....

..... [1]

(ii) the average separation of the molecules.

.....

..... [1]

3. Fig. 3 shows a sealed glass syringe that contains air and many very tiny suspended dust particles.

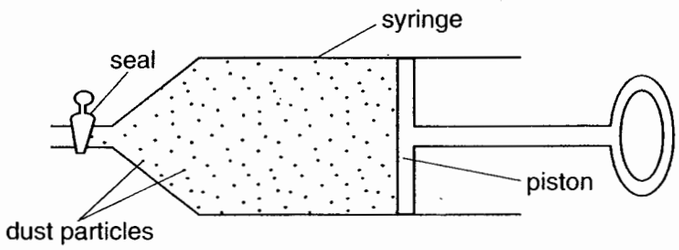


Fig. 3

(a) Explain why the dust particles are suspended in the air and do not settle to the bottom.

.....

.....

.....

.....[3]

(b) The air in the syringe is at a pressure of 2.0×10^5 Pa. The piston is slowly moved into the syringe, keeping the temperature constant, until the volume of the air is reduced from 80 cm^3 to 25 cm^3. Calculate the final pressure of the air.

pressure = ...[3]

For Examiner's Use

4 Fig. 4. shows water being heated by an electrical heater. The water in the can is not boiling, but some is evaporating.

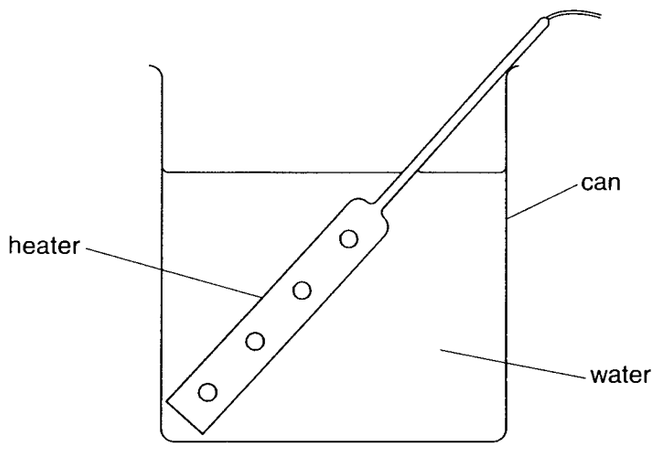


Fig. 4

(a) Describe, in terms of the movement and energies of the water molecules, how evaporation takes place.

.....

.....

.....

..... [2]

(b) State two differences between evaporation and boiling.

1 .....

.....

2 .....

..... [2]

(c) After the water has reached its boiling point, the mass of water in the can is reduced by 3.2 g in 120 s. The heater supplies energy to the water at a rate of 60 W. Use this information to calculate the specific latent heat of vaporisation of water.

specific latent heat = ... [3]

For Examiner's Use

5 **(a)** Equal volumes of nitrogen, water and copper at 20 °C are heated to 50 °C.

(i) Which one of the three will have a much greater expansion than the other two?

.....

(ii) Explain your answer in terms of the way the molecules are arranged in the three substances.

.....

.....

.....

[3]

(b) Fig. 5 shows a thermometer with a range of −10 °C to 50 °C.

Fig. 5

Explain what is meant by

(i) the *sensitivity* of a thermometer,

.....

.....

(ii) the *linearity* of a thermometer.

.....

.....

[2]

For Examiner's Use

6. A thermocouple is used to measure the temperature of the inner wall of a pottery kiln.

(a) In the space below, draw a labelled diagram of a thermocouple that could be used for this purpose. [2]

(b) Describe

(i) how you would read the temperature of the wall from the thermocouple,

.....

.....

(ii) how the thermocouple works.

.....

.....

.....

[2]

(c) State two conditions in which a thermocouple is very suitable for temperature measurement.

.....

.....[2]

7. Fig. 6 shows apparatus that a student uses to make an estimate of the specific heat capacity of iron.

For Examiner's Use

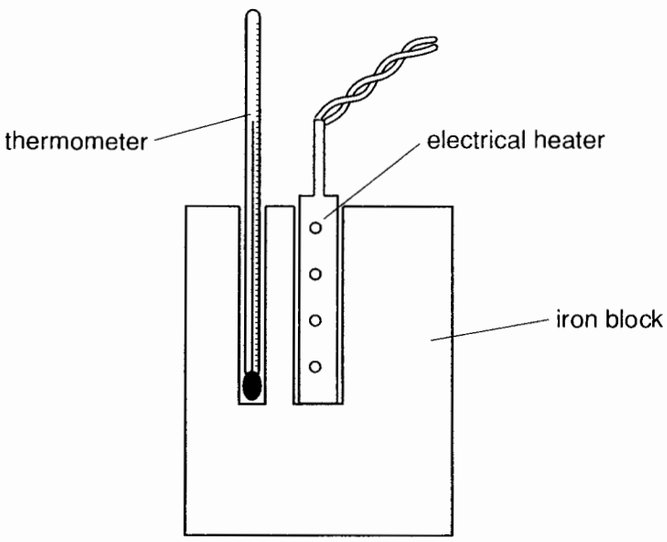


Fig. 6

(a) The power of the heater is known. State the four readings the student must take to find the specific heat capacity of iron.

1. .....

2. .....

3. .....

4. ..... [3]

(b) Write down an equation, in words or in symbols, that could be used to work out the specific heat capacity of iron from the readings in **(a)**.

[2]

(c) **(i)** Explain why the value obtained with this apparatus is higher than the actual value.

For Examiner's Use

.....

..... [1]

(ii) State one addition to the apparatus that would help to improve the accuracy of the value obtained.

.....

..... [1]