Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

8269683414

PHYSICS **0625/31**

Paper 3 Extended **October/November 2014**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Take the weight of 1 kg to be 10 N (i.e. acceleration of free fall = $10\,m/s^2$).

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **20** printed pages.

DC (NH/JG) 81775/4

CAMBRIDGE
International Examinations

1 **(a)** Fig. 1.1 shows the distance-time graphs for three different objects A, B and C.

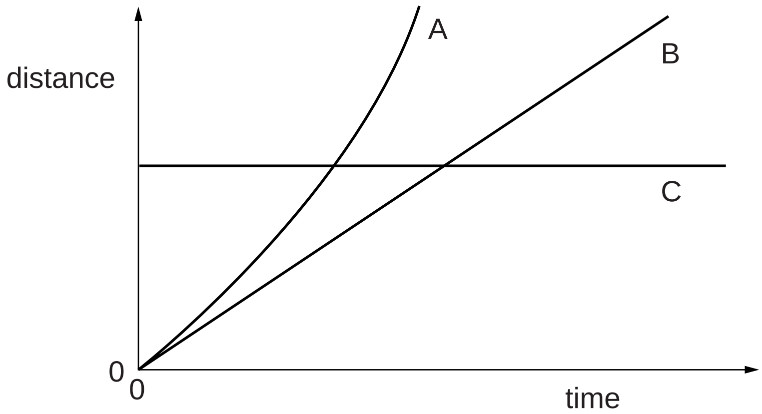

Fig. 1.1

Describe the motion of each of the objects A, B and C by selecting the appropriate description from the list below.

constant speed   increasing speed   decreasing speed   stationary

A ....

B ....

C ....
[2]

(b) Fig. 1.2 shows the speed-time graphs for three more objects D, E, and F.

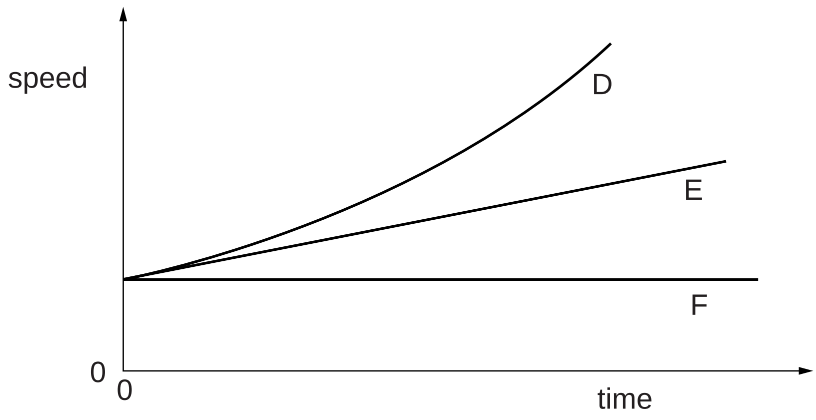

Fig. 1.2

Describe the motion of each of the objects D, E and F by selecting the appropriate description from the list below.

constant speed constant acceleration increasing acceleration stationary

D ....

E ....

F ....
[2]

(c) Fig. 1.3 shows a person bungee-jumping from a bridge. The person is attached to a long elastic rope.

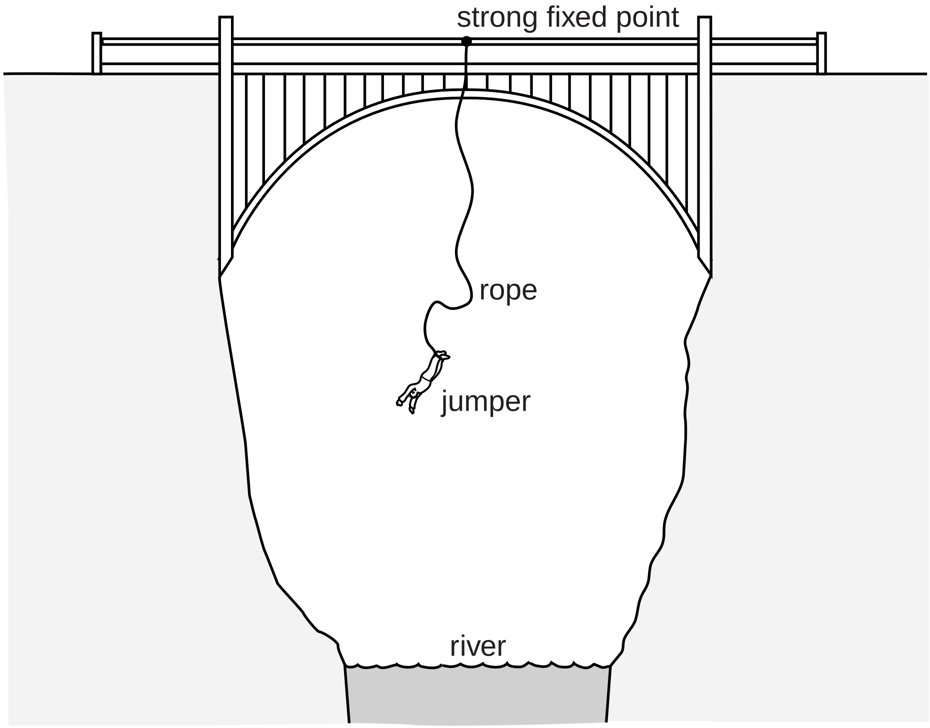

Fig. 1.3

(i) In 1.5 s the speed of the jumper increases from zero to 10.5 m / s.

Calculate her average acceleration during this time.

acceleration = ...[2]

(ii) At one point during the fall, she reaches her maximum speed.

1. State her acceleration at this point.

acceleration = ...[1]

2. What can be said about the forces acting on her at this point?

....

....[1]

[Total: 8]

Turn over for Question 2

2 A diver climbs some steps on to a fixed platform above the surface of the water in a swimming-pool.

He dives into the pool. Fig. 2.1 shows the diver about to enter the water.

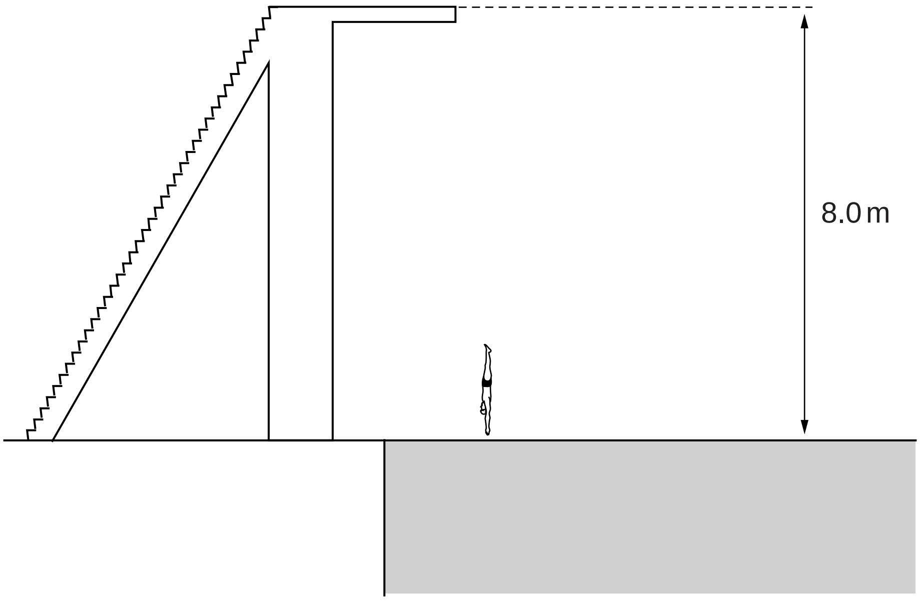

Fig. 2.1

The mass of the diver is 65 kg. The platform is 8.0 m above the surface of the water.

(a) Calculate

(i) the increase in the gravitational potential energy of the diver when he climbs up to the platform.

increase in gravitational potential energy = ...[1]

(ii) the speed with which the diver hits the surface of the water. Ignore any effects of air resistance.

speed = ...[4]

(b) In another dive from the same platform, the diver performs a somersault during the descent. He straightens, and again enters the water as shown in Fig. 2.1.

Discuss whether the speed of entry into the water is greater than, less than or equal to the speed calculated in **(a)(ii)**. Ignore any effects of air resistance.

....

....

....

....[3]

[Total: 8]

3 **(a)** Fig. 3.1 shows an oil can containing only air at atmospheric pressure.

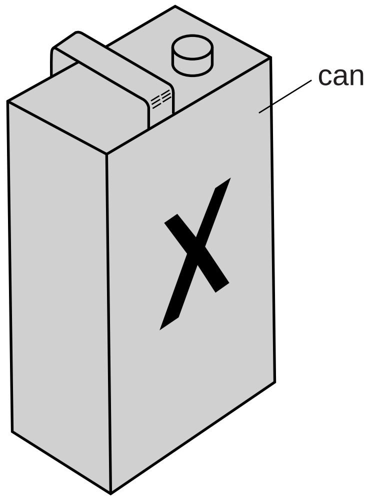

Fig. 3.1

Atmospheric pressure is 1.0×10^5 Pa.

The pressure of the air in the can is reduced by means of a pump. The can collapses when the pressure of the air in the can falls to 6000 Pa.

(i) Explain why the can collapses.

....

....[1]

(ii) The surface area of face X of the can is $0.12\,m^2$.

Calculate the resultant force on face X when the can collapses.

force = ...[3]

(b) Mercury is poured into a U-shaped glass tube. Water is then poured into one of the limbs of the tube. Oil is poured into the other limb until the surfaces of the mercury are at the same level in both limbs.

Fig. 3.2 shows the result.

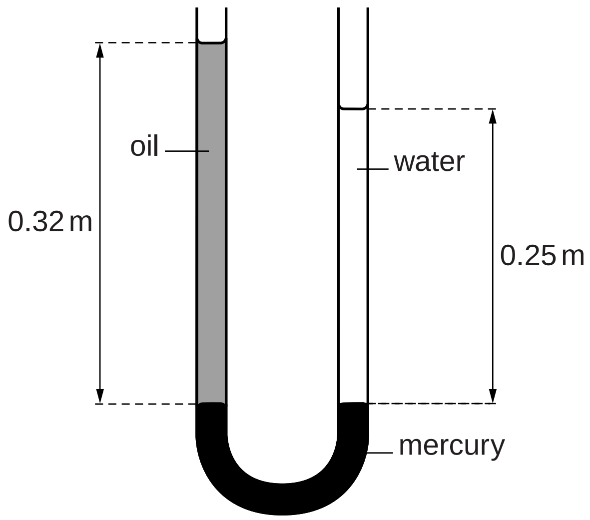

Fig. 3.2

(i) State a condition that must be true in order for the mercury surfaces to be at the same level in both limbs of the tube.

....[1]

(ii) The height of the water column is 0.25 m. The height of the oil column is 0.32 m. The density of water is 1000 kg / m^3.

Calculate

1. the pressure exerted by the water on the surface of the mercury,

pressure = ...[2]

2. the density of the oil.

density = ...[2]

[Total: 9]

4 Fig. 4.1 shows some of the apparatus that a student uses to determine the specific heat capacity of aluminium.

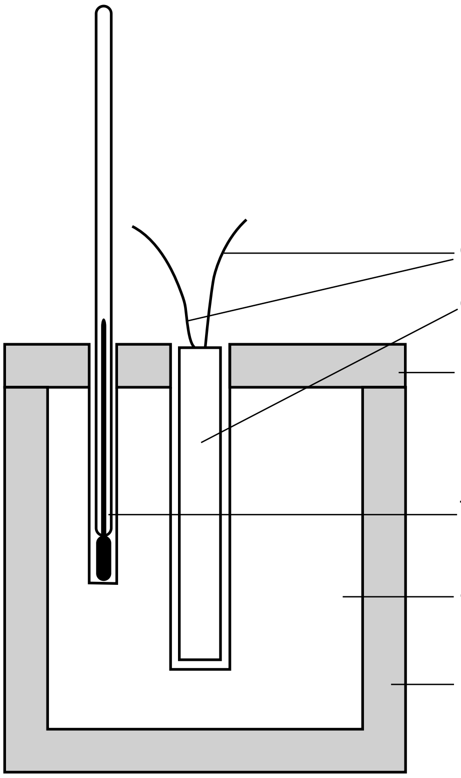

Fig. 4.1

(a) State the measurements the student needs to make, including those from the electric circuit. For each quantity measured, state a symbol.

....

....

....

....

....

....

....[4]

(b) Use your symbols from **(a)** to complete the formula used to determine the specific heat capacity *c*.

specific heat capacity *c* =

....[2]

(c) Another student performs the experiment without using insulation. He obtains a higher value for *c*.

Explain why this student's measurements lead to this higher value.

....

....[1]

[Total: 7]

5 **(a)** Two types of seismic waves are produced by earthquakes. They are called P-waves and S-waves. P-waves are longitudinal and S-waves are transverse.

(i) Explain what is meant by the terms *longitudinal* and *transverse*.

longitudinal ....

....

transverse ....

.... [2]

(ii) State another example of

1. a longitudinal wave, ...

2. a transverse wave. .... [2]

(iii) A seismic wave has a speed of 7.2 km / s and a frequency of 30 Hz.

Calculate its wavelength.

wavelength = ...[2]

(b) Fig. 5.1 shows an electric bell ringing in a sealed glass chamber containing air.

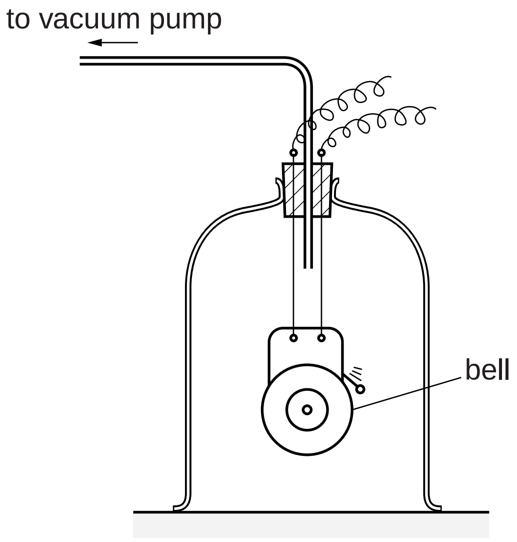

Fig. 5.1

A student hears the bell ringing. The air is then removed from the chamber.

State and explain any change in the sound heard by the student.

....

....

....

....[2]

[Total: 8]

6 **(a)** Fig. 6.1 shows an object O placed in front of a plane mirror M. Two rays from the object to the mirror are shown.

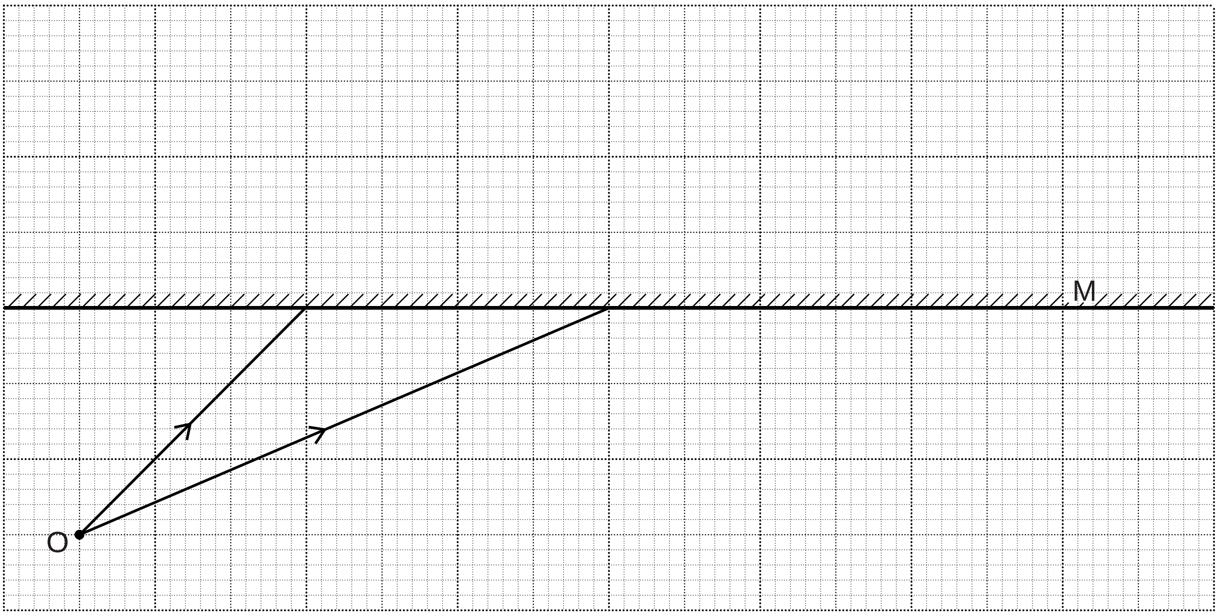

Fig. 6.1

(i) On Fig. 6.1, for **one** of the rays shown,

1. draw the normal to the mirror,

2. mark the angle of incidence. Label this angle X.

[2]

(ii) On Fig. 6.1, draw

1. the reflected rays for both incident rays,

2. construction lines to locate the image of O. Label this image I.

[2]

(b) In Fig. 6.2, circular wavefronts from a point source in a tank of water strike a straight barrier.

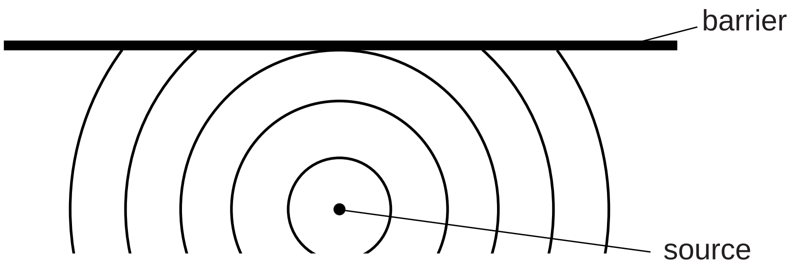

Fig. 6.2

(i) The reflected wavefronts seem to come from a single point.

On Fig. 6.2, mark a dot to show the position of this point. Label this point C. [1]

(ii) Draw, as accurately as you can, the reflected circular wavefronts. [2]

[Total: 7]

7 A small cylinder of compressed helium gas is used to inflate balloons for a celebration.

(a) **(i)** In the box below, sketch a diagram to represent the arrangement of helium molecules in a balloon.

[2]

(ii) State and explain how the size of the attractive forces acting between the molecules of a gas compares with the size of the attractive forces between the molecules of a solid.

....

....

....[2]

(b) The helium in the cylinder has a volume of $6.0 \times 10^{-3}\,\text{m}^3$ ($0.0060\,\text{m}^3$) and is at a pressure of $2.75 \times 10^6\,\text{Pa}$.

(i) The pressure of helium in each balloon is $1.1 \times 10^5\,\text{Pa}$. The volume of helium in an inflated balloon is 3.0×10^{-3} ($0.0030\,\text{m}^3$). The temperature of the helium does not change.

Calculate the number of balloons that were inflated.

number of balloons = ...[3]

(ii) Later, the temperature increases and some of the balloons burst.

Suggest and explain why this happens.

....

....

....[2]

[Total: 9]

8 A charger for a cellphone (mobile phone) is marked:

input: a.c. 240 V, 50 Hz, 80 mA.
output: d.c. 5.3 V, 500 mA.

(a) State

(i) the component in the charger that converts a.c. to d.c.,

....

(ii) the quantity that has the value 50 Hz.

....
[2]

(b) Calculate

(i) the output power of the charger,

output power = ...[2]

(ii) the energy transferred in the output circuit when the cellphone is charged for 1.5 hours.

energy = ...[2]

(c) In the following list, underline the quantity that is stored in the battery of the cellphone.

voltage current power energy [1]

[Total: 7]

9 A technician sets up a radiation detector in a university laboratory, for use in some experiments. Even before the radioactive source for the experiment is brought into the laboratory, the detector registers a low count rate.

(a) Suggest what causes this count rate.

....[1]

(b) A radioactive source that emits α-particles is placed on the laboratory bench and the source is gradually moved closer to the detector.

At first, the detector continues to register a low count rate sometimes slightly less than the count rate registered without the source. The count rate suddenly increases to a very high value when the source is very close to the detector.

Explain these changes in the count rate.

....

....

....

....

....[3]

(c) In a second experiment, α-particles pass between two parallel, horizontal metal plates in a vacuum.
They then continue to the detector as shown in Fig. 9.1.

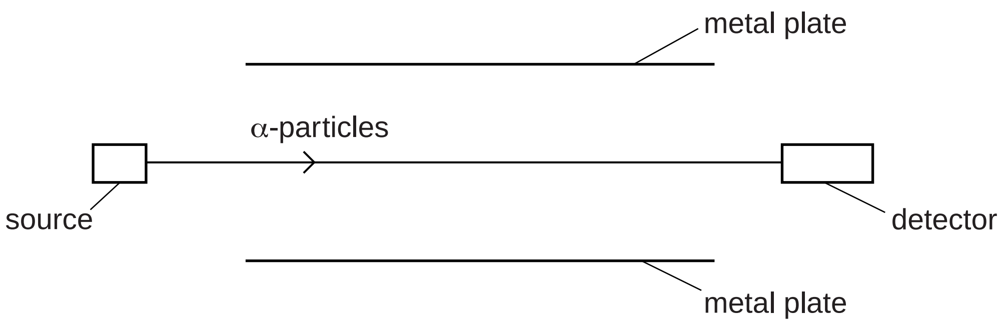

Fig. 9.1

A positive charge is established on the upper plate and a negative charge on the lower plate.

(i) On Fig. 9.1, sketch the new path of the α-particles. [2]

(ii) State what happens to the count rate registered by the detector.

....

....[1]

[Total: 7]

10 **(a)** In a room in a house there are four electric lamps in parallel with each other, controlled by a single switch.

With all the lamps working, one of the lamp filaments suddenly breaks.

What, if anything happens to the remaining lamps? Explain your answer.

....

....

....

....[2]

(b) Fig. 10.1 shows the circuit diagram for the lamp in another room. X and Y are 2-way switches.

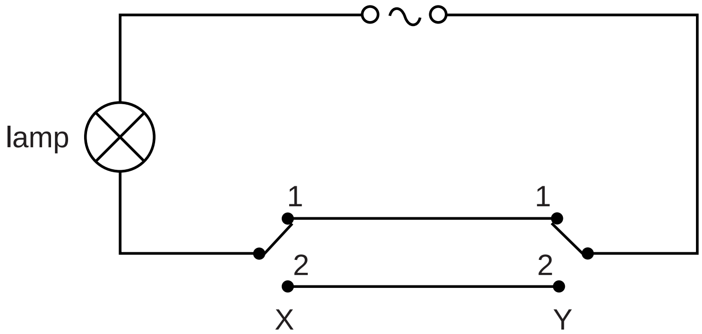

Fig. 10.1

(i) Complete the table, by indicating whether the lamp is on or off for each of the switch positions.

position of switch X	position of switch Y	state of lamp
1	1	
1	2	
2	1	
2	2	

[2]

(ii) Explain why this arrangement of switches is useful.

....

....[1]

[Total: 5]

11 (a) Name the process that causes a potential difference across a solenoid due to the movement of a nearby magnet.

....[1]

(b) Fig. 11.1 shows a solenoid connected to a centre-zero voltmeter, M.

A bar magnet is held with its N-pole close to one end of the solenoid.

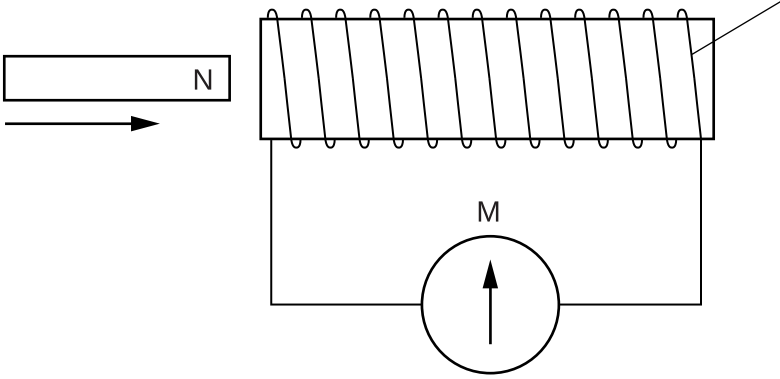

Fig. 11.1

(i) The magnet is pushed into the solenoid, and then brought to rest with its N-pole just inside the solenoid.

Describe the movement of the pointer of the meter M.

....

....[2]

(ii) The magnet is now pulled to the left out of the solenoid, at a higher speed than in **(i).**

Compare the movement of the pointer of the meter with that seen in **(i)**.

....

....[2]

[Total: 5]