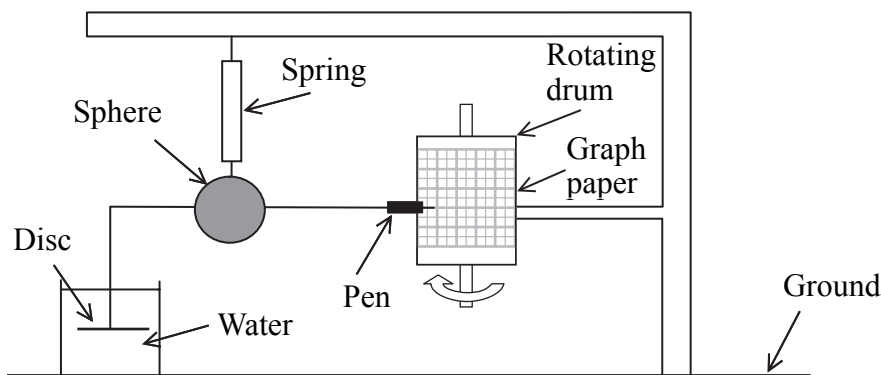




**Answer ALL the questions.**

**1. This question is about forces and motion.**

The diagram below shows apparatus for recording ground movement during an earthquake. A large solid sphere is suspended from a strong spring. A metal disc and a pen are attached to the sphere. The disc is placed in a container of water. A sheet of graph paper on a rotating drum moves steadily past the pen.



(a) (i) The sphere has a mass of 30 kg. Calculate the weight of the sphere.

.....  
 .....  
**(1)**

(ii) The apparatus is to be used in different parts of the world. Explain what difference, if any, this could make to the values of the mass and weight of the sphere.

Mass .....

Reason (if any) .....

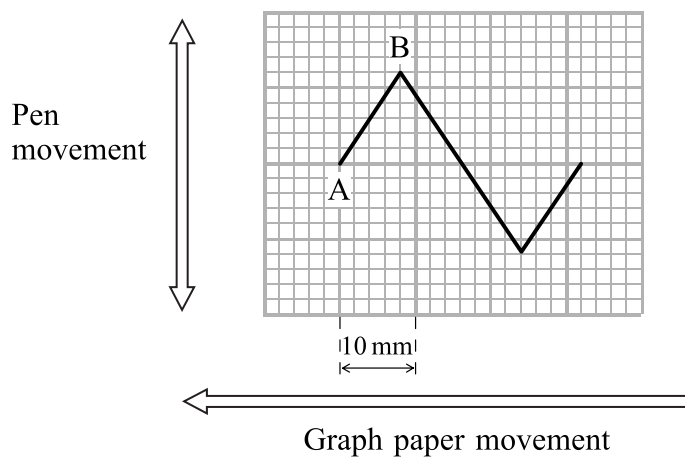
Weight .....

Reason (if any) .....

**(3)**



- (b) The graph paper moves horizontally at a constant speed of 10 mm/s. During a ground movement the pen moves vertically. The resulting trace is shown below.



The trace can be considered to be a displacement–time graph.

- (i) What feature of the graph represents the velocity of the pen?

.....  
.....  
**(1)**

- (ii) Calculate the time taken to produce the line AB.

.....  
.....  
.....  
.....  
**(2)**

- (iii) State the vertical displacement of the pen in this time.

.....  
.....  
**(1)**



(iv) Calculate the velocity of the pen during this time.

.....  
.....  
.....  
.....

**(2)**

(v) Explain why the unbalanced force acting on the pen is zero.

.....  
.....

**(1)**

(c) (i) Describe the arrangement and motion of the molecules in air.

Arrangement .....

.....

Motion .....

.....

**(2)**

(ii) Describe the arrangement and motion of the molecules in water.

Arrangement .....

.....

Motion .....

.....

**(2)**

(iii) When the metal disc is made larger what difference, if any, is there in the trace?

.....  
.....

**(1)**



Leave  
blank

(iv) Why would this apparatus not work at a temperature of  $-15\text{ }^{\circ}\text{C}$ ?

.....  
.....  
.....  
.....

(2)

(v) Explain why the disc is still subjected to a pressure when the water is removed.

.....  
.....  
.....  
.....

(2)

Q1

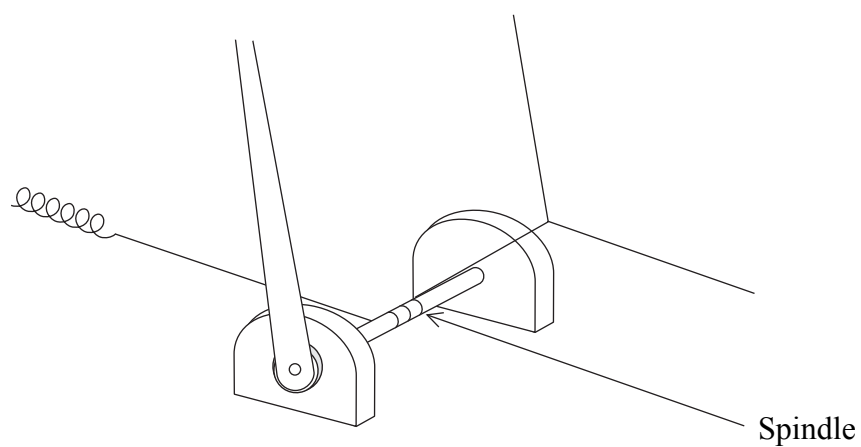
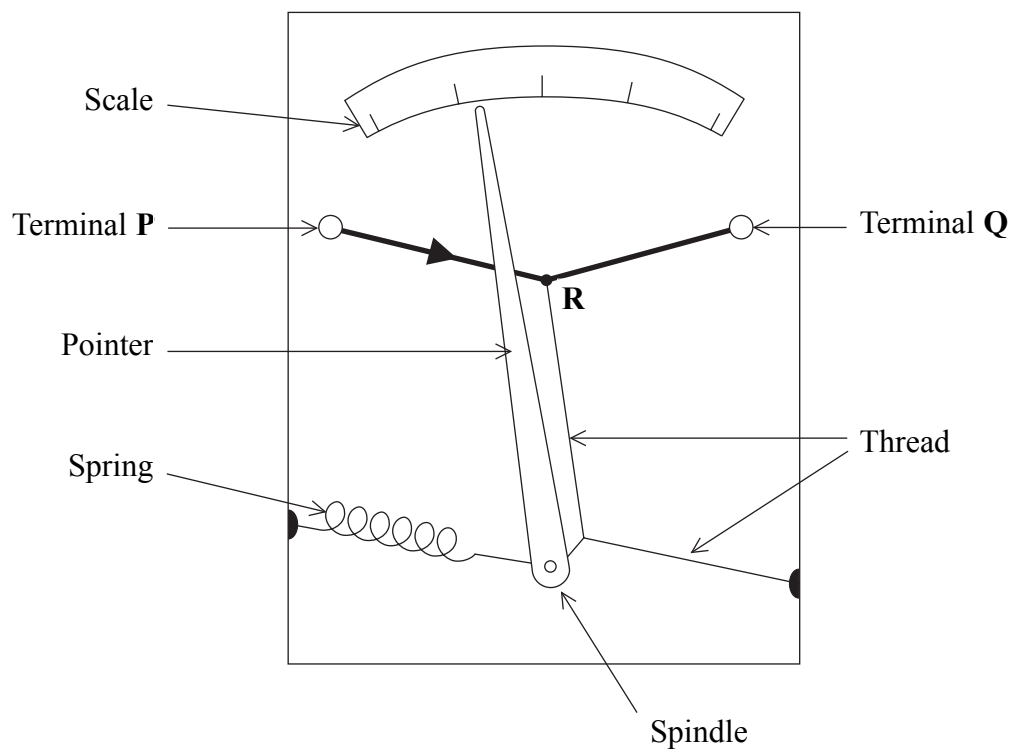
(Total 20 marks)

--	--



**2. This question is about heat.**

The diagrams show the structure of a device that can be used to measure electric current.



Some thread is wrapped around the pointer spindle. When there is current in the wire **PQ** the point **R** is pulled down by the spring and the pointer then moves over the scale.



(a) Explain why the length of the wire between **P** and **Q** increases when there is a current in it.

.....  
.....  
.....  
.....

**(2)**

(b) Does the tension in the spring increase, decrease or stay the same when there is a current in the wire? Explain your answer.

.....  
.....  
.....  
.....

**(2)**

(c) Explain why the spring needs to behave elastically.

.....  
.....  
.....  
.....

**(2)**

(d) For any given current the wire **PQ** reaches a steady temperature. Explain why the temperature does not rise further.

.....  
.....  
.....  
.....

**(2)**



(e) The mass of the wire between **P** and **Q** is 0.000040 kg. During operation the temperature of this wire rises from 20 °C to 200 °C in the first 0.20 s. Calculate

(i) the heat energy absorbed by the wire during this time.  
 [Specific heat capacity of the material of the wire is 500 J/(kgK)]

.....  
 .....  
 .....  
 .....  
 .....

**(3)**

(ii) the rate at which heat energy is absorbed by the wire during this time.

.....  
 .....  
 .....

**(2)**

(f) In an experiment using this device, the change in length of the spring was measured for different currents. The table shows the values obtained.

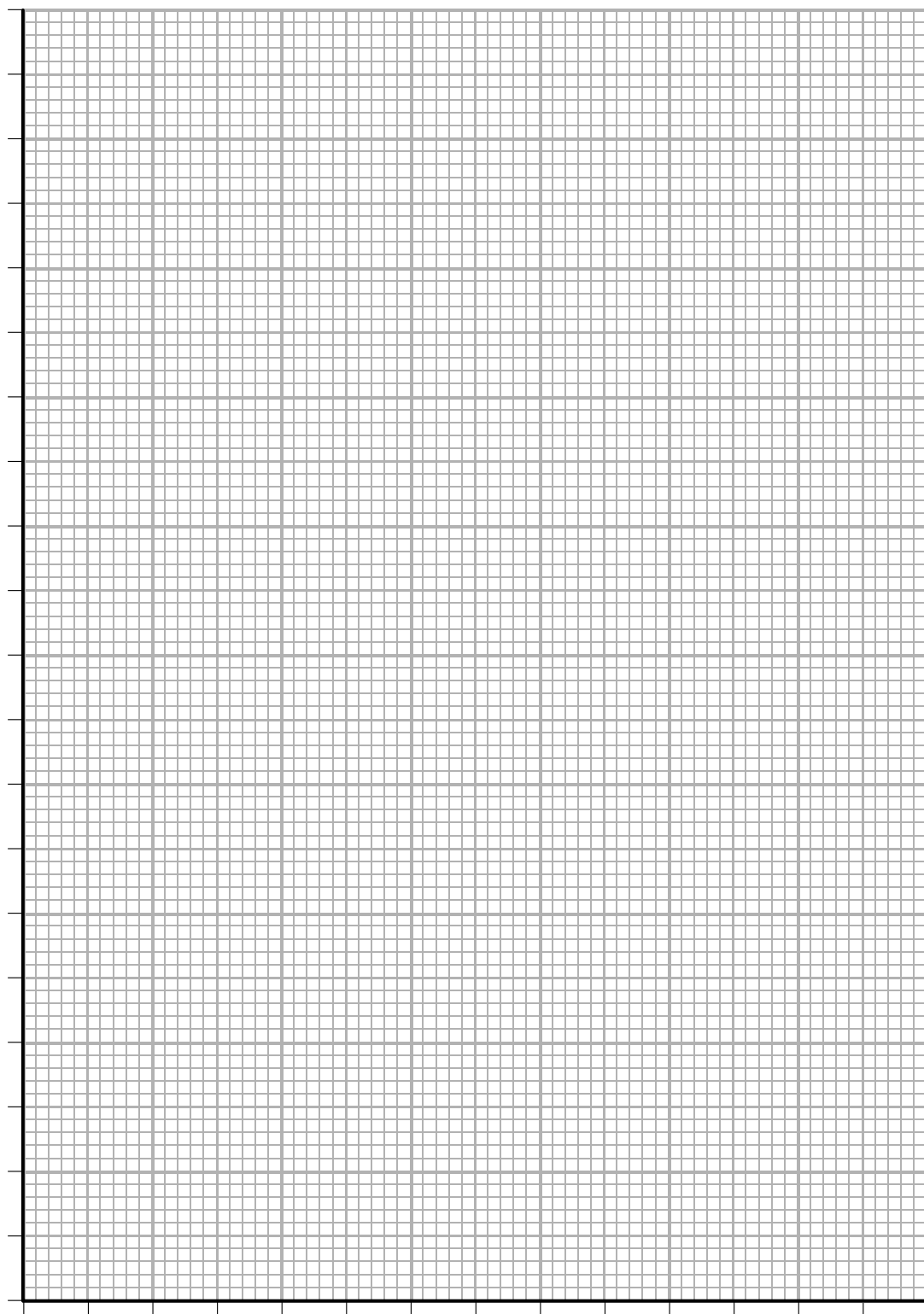
Change of length/mm	0.00	0.07	0.16	0.28	0.43	0.62	0.90
Current/A	0.00	0.20	0.40	0.60	0.80	1.00	1.20

(i) Plot a graph of change of length (*y*-axis) against current (*x*-axis) on the graph paper provided. Label the axes and choose a sensible scale that makes full use of the graph paper. Draw the best-fit curve through the points.





Leave  
blank



(5)

(ii) Use the graph to find the current that will cause the spring to change length by 0.50 mm. Show, on the graph, how you obtained your value.

Value of current .....

(2)

(Total 20 marks)

Q2

--	--



Leave  
blank

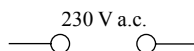
**BLANK PAGE**



**3. This question is about mains electricity.**

(a) A qualified electrician measures the power rating of a lamp designed to operate normally at 230 V.

(i) Draw a circuit diagram of the arrangement of apparatus the electrician needs to measure the power of this lamp. The mains supply has been drawn for you.



**(3)**

(ii) Calculate the power rating of a lamp with a voltage of 230 V and a current of 0.44 A.

.....  
.....  
.....  
.....

**(2)**

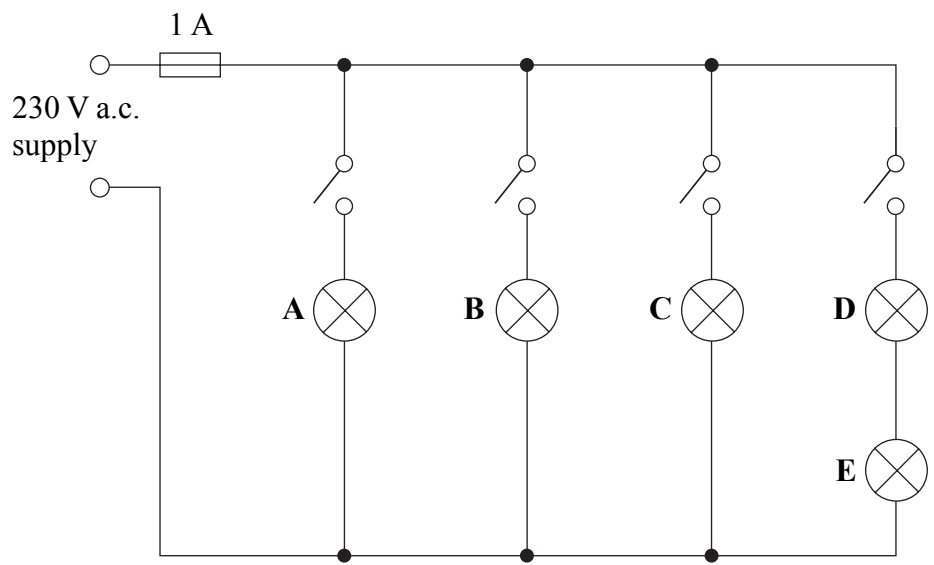
(iii) Why should such a circuit only be set up by a qualified electrician?

.....  
.....

**(1)**



(b) The diagram shows a house lighting circuit containing five identical lamps. Each of the lamps normally passes a current of 0.44 A. The circuit includes a 1 A fuse.



(i) Are lamps **A**, **B** and **C** in series or in parallel? Put a cross (☒) in the correct box.

Series

Parallel

(1)

(ii) What is the purpose of a fuse? Explain how it works.

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4)



Leave blank

(iii) Is the 1 A fuse appropriate for this circuit? Give a reason for your answer.

.....  
.....  
.....  
.....  
.....  
.....

**(3)**

(iv) Lamps **D** and **E** are controlled by a single switch. State and explain the difference in appearance between lamp **E** and lamp **A** when they are switched on.

.....  
.....  
.....  
.....

**(2)**

(c) It is now usual to connect a third wire to the metal parts of the lamp holders and switches used in mains circuits.

(i) What name is given to this third wire?

.....

**(1)**

(ii) What is its purpose?

.....  
.....

**(1)**

(iii) Explain how it works.

.....  
.....  
.....  
.....  
.....

**(2)**

**(Total 20 marks)**

**Q3**

--	--



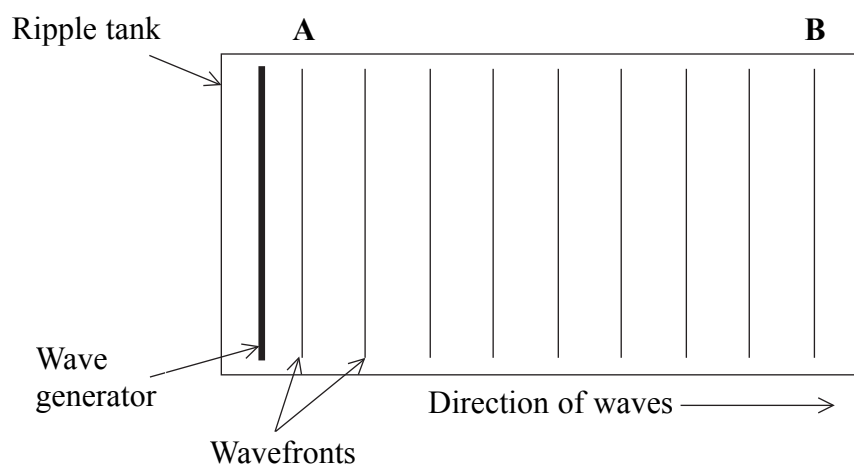
Leave  
blank

**BLANK PAGE**



**4. This question is about wave properties.**

(a) The diagram represents waves being produced in a ripple tank.



(i) Use a ruler to measure the spacing of the wavefronts as accurately as possible.

.....  
.....  
.....  
.....

**(2)**

(ii) Calculate the wavelength of these waves.  
(1 cm on the diagram represents 5 cm.)

.....  
.....

**(1)**

(iii) It takes a wavefront 1 second to travel from A to B. What is the frequency of the waves?

.....  
.....

**(1)**



(iv) Calculate the speed of the waves.

.....  
.....  
.....  
.....

**(2)**

(v) Some of the water in the ripple tank is removed to make the water much shallower. What effect, if any, would this have on the wavelength, the frequency and the speed of the waves?

Wavelength .....

.....

Frequency .....

.....

Speed .....

.....

**(3)**

(b) During a thunderstorm a student measures the time between seeing a flash of lightning and hearing the thunder. This time is 6.0 s.

(i) How does the speed of light compare with the speed of sound?

.....  
.....

**(1)**

(ii) The student consults a data book which gives the speed of sound in air as 340 m/s . Calculate how far the student was from the flash of lightning.

.....  
.....  
.....  
.....

**(2)**





Leave  
blank

(iii) Give two reasons why the speed of sound in air might differ from that given in the data book.

Reason 1 .....

.....

Reason 2 .....

.....

**(2)**

(c) On a different day the student decides to measure the speed of sound in the open air. He asks another student to stand 350 m away in a large open space.

(i) Name three essential items of apparatus they will need.

Item 1 .....

.....

Item 2 .....

.....

Item 3 .....

.....

**(3)**

(ii) Describe the measurements they need to make.

.....

.....

.....

.....

.....

.....

**(3)**

**Q4**

**(Total 20 marks)**

--	--

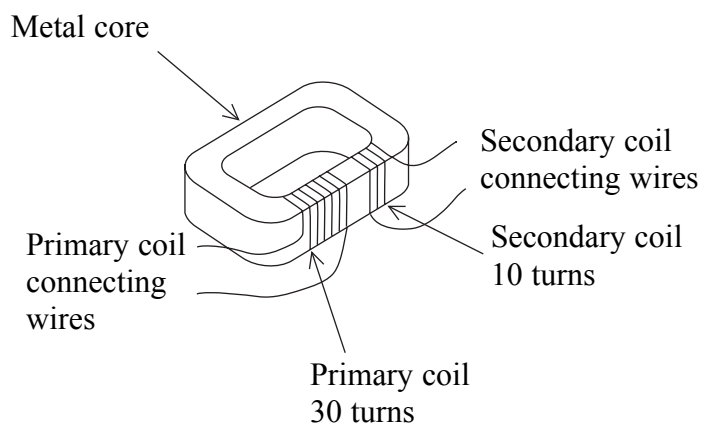


Leave  
blank

**BLANK PAGE**



5. This question is about transformers and the design of an experiment.



(a) The diagram shows two insulated copper wire coils wound onto a metal core to make a simple transformer.

(i) Name the most suitable material for the metal core.

.....  
.....

(1)

(ii) Explain the reason for your choice of material.

.....  
.....  
.....  
.....

(1)

(iii) The primary coil is connected to a 12 V a.c. supply. Calculate the voltage that would be induced across the secondary coil assuming the transformer is ideal.

.....  
.....  
.....  
.....

(2)



(b) A student decides to investigate how the voltage produced across the secondary coil depends on the number of turns on the secondary coil.

Describe how the student would perform this investigation.

Your account should include:

(i) two factors that must be kept constant to ensure that the results are reliable

Factor 1 .....

Factor 2 .....

**(2)**

(ii) a circuit diagram showing all the components needed  
(The supply should be drawn like this —○ ○—)

**(3)**

(iii) two measurements that must be taken

Measurement 1 .....

Measurement 2 .....

**(2)**



Leave blank

(iv) a description of how the apparatus is to be used

.....

.....

.....

.....

.....

.....

.....

.....

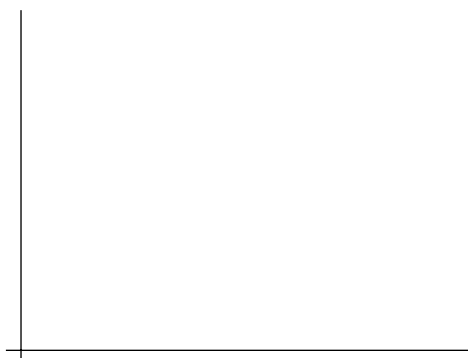
.....

.....

.....

(5)

(v) a labelled sketch graph to show the expected results.



(2)

(c) Give a reason why voltages induced across the secondary coil would be less than expected.

.....

.....

.....

.....

(2)

Q5

(Total 20 marks)

**TOTAL FOR PAPER: 100 MARKS**

**END**



**BLANK PAGE**



**BLANK PAGE**



N 2 6 7 6 5 A 0 2 3 2 4

**BLANK PAGE**

