

Answer ALL the questions.

1. (a) Fill in the gaps below to complete the statement about vector and scalar quantities.

..... quantities have size and direction while
 quantities have only

(3)

(b) The table below contains vector and scalar quantities. Fill the gaps with two more suitable quantities chosen from the list.

Vectors	Scalars
displacement	distance
force	mass
velocity	speed

List		
acceleration	area	density
momentum	temperature	weight

(2)



Leave blank

(c) A box of mass 6.0 kg is moved along a horizontal frictionless surface by a force of 10 N. The opposing force is 2.0 N.



(i) Name the opposing force.

..... (1)

(ii) State the horizontal unbalanced force acting on the box and the direction in which it acts.

Unbalanced force.....

Direction.....

(2)

(iii) Calculate the acceleration of the box.

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

(2)

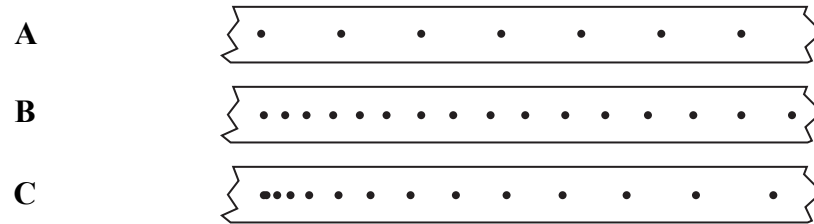
Q1

(Total 10 marks)



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2. The diagram shows three ticker-timer tapes **A**, **B** and **C** obtained from three different experiments.



Dots are marked on each tape every 0.020 second. Two of the tapes show constant acceleration.

(a) (i) State which tape, **A**, **B** or **C**, shows the greatest acceleration. Put a cross (☒) in the correct box.

A ☐ B ☐ C ☐ (1)

(ii) Explain your answer.

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

(b) By taking measurements from tape **B** determine the average speed.

.....
.....
..... (3)

(c) (i) Why is it difficult to calculate the average speed in tape **C**?

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

(ii) Why is it possible to calculate the constant acceleration in tape **C**?

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

(Total 7 marks)

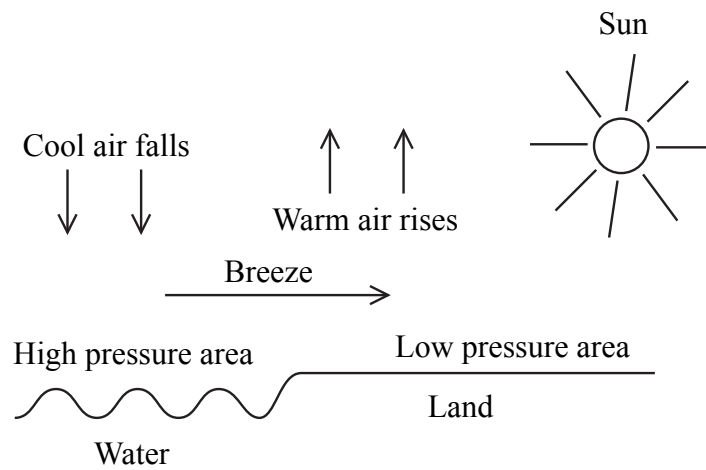
Q2



3. (a) Heat energy transfer can take place by the process of convection. Name two other heat energy transfer processes.

..... and (2)

(b) The diagram below shows how the process of convection leads to a breeze coming off the sea during daytime.



During this process the air above the land is heated by the sun and the warm air rises.

(i) Explain why warm air rises.

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

(ii) Define specific heat capacity.

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

(iii) The land is hotter than the sea. Which has the greater specific heat capacity, land or sea?

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

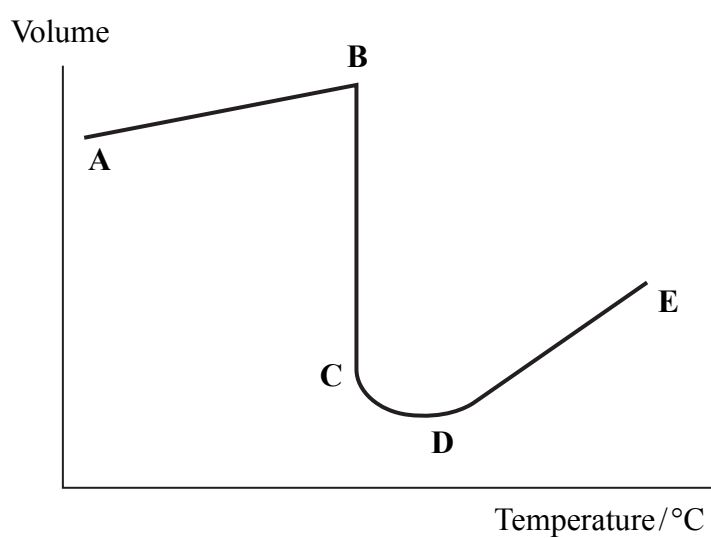
(Total 5 marks)

Q3



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4. The graph below shows how the volume of a fixed mass of a substance varies with increasing temperature.



- (a) (i) What is happening to the substance over the part **BC** of the graph?

..... (1)

- (ii) Over which part of the graph is the rate of expansion the greatest?
Put a cross (☒) in the correct box.

AB ☒ CD ☒ DE ☒

(1)

- (iii) Explain your answer.

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

- (b) Indicate at which point, **A**, **B**, **C**, **D** or **E**, the substance has maximum density.
Put a cross (☒) in the correct box.

A ☒ B ☒ C ☒ D ☒ E ☒

(1)

- (c) Name a substance whose behaviour could be represented by the graph.

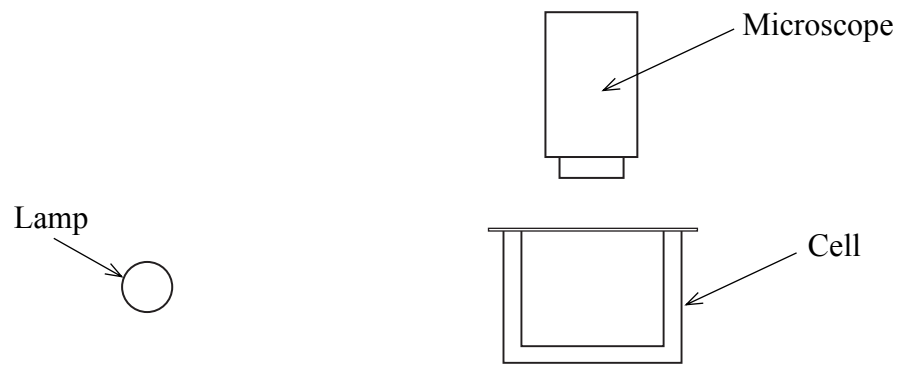
..... (1)

Q4

(Total 5 marks)



5. Some of the apparatus required to observe the motion of smoke particles in air is shown below.



(a) Place an **X** in the region where the smoke should be introduced. (1)

(b) What is the name given to the motion of the smoke particles in this experiment?
..... (1)

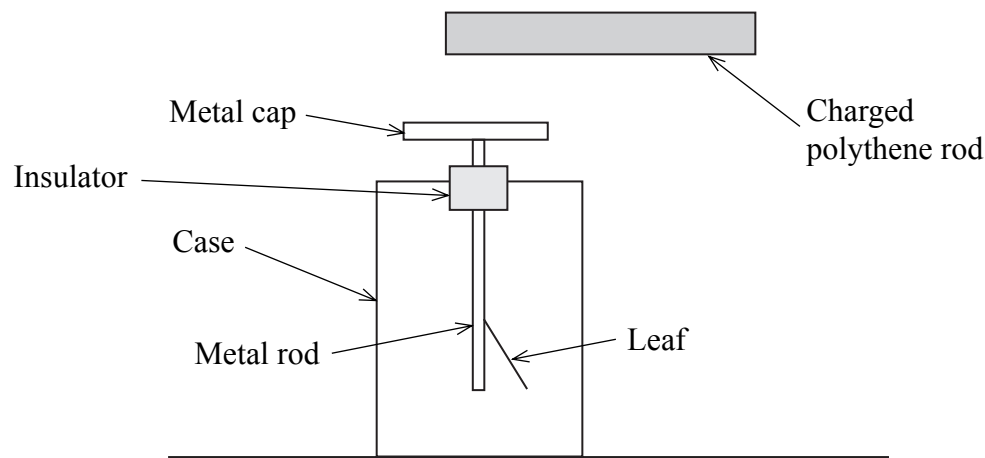
(c) Describe what is seen when looking through the microscope.
.....
.....
..... (2)

(d) Describe one change to the motion of the smoke particles if the experiment was conducted at a higher temperature.
.....
..... (1)

(Total 5 marks) Q5



6. The diagram shows a charged polythene rod held near the metal cap of an uncharged leaf electroscope, causing the leaf to deflect.



(a) What is the sign of the charge on the polythene rod?

..... (1)

(b) Explain in terms of electrons why the leaf is deflected as shown.

.....
.....
.....
.....
.....
.....
.....
.....
..... (4)

(c) What difference, if any, will there be in the behaviour of the leaf if the experiment is repeated using a charged perspex rod?

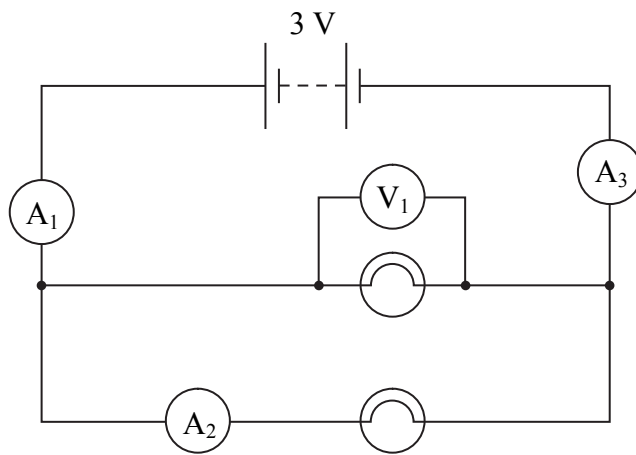
.....
..... (1)

(Total 6 marks)

Q6



7. Two identical lamps, a voltmeter and three ammeters are connected as shown.



(a) The ammeter A_1 reads 0.50 A. What will ammeters A_2 and A_3 read?

A_2

A_3

(2)

(b) What will voltmeter V_1 read?

.....

(1)

(c) Calculate the resistance of one of the lamps.

.....

.....

.....

.....

(2)

(d) What will a voltmeter read if it is connected across any one of the ammeters? Give a reason for your answer.

Reading

Reason

.....

.....

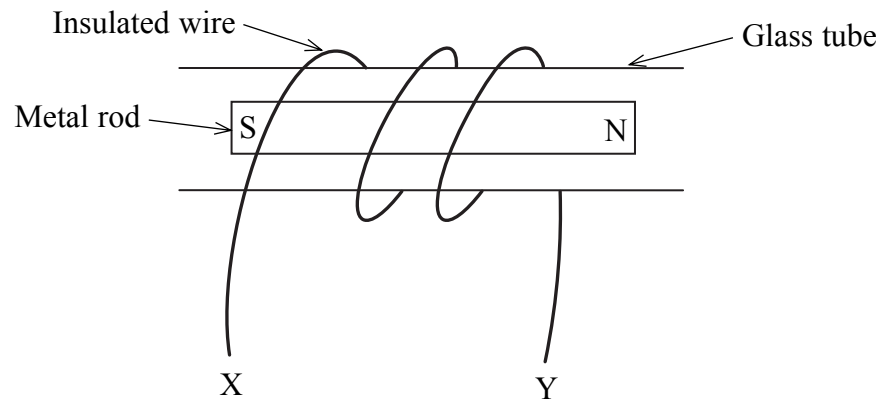
(2)

Q7

(Total 7 marks)



8. An electromagnet can be made by winding several turns of insulated metal wire around a glass tube containing an unmagnetised metal rod. When a direct current is passed through the wire the rod becomes magnetised as shown.



(a) (i) What is the most suitable metal for the rod? Give a reason for your answer.

Metal

Reason

.....

.....

(2)

(ii) What is the most suitable metal for the wire? Give a reason for your answer.

Metal

Reason

.....

.....

(2)

(b) To produce the polarity in the metal rod shown, should the current pass from X to Y or from Y to X? Put a cross (☒) in the correct box.

X to Y

Y to X

(1)

(c) Give one way in which a stronger magnetic field could be produced in the metal rod.

.....

.....

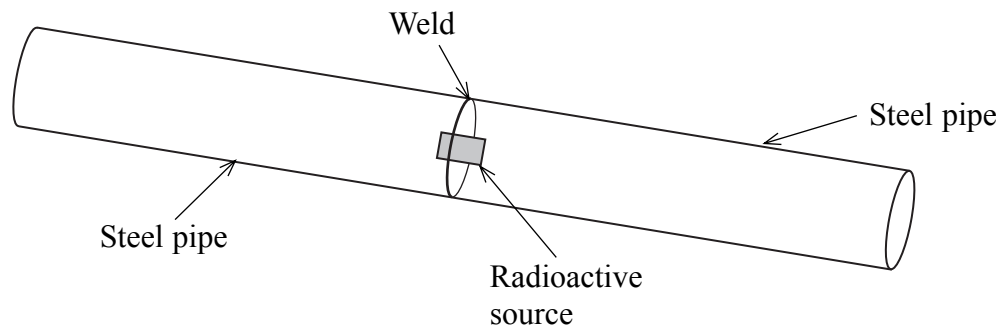
(1)

(Total 6 marks)

Q8



9. The diagram shows a section of a pipeline used to carry gas at high pressure. To form the pipeline, short lengths of steel pipe are welded together.



The thickness of a weld can be calculated by placing a radioactive source inside the steel pipe at the position of the weld. The amount of radiation which penetrates the weld depends on its thickness.

(a) (i) What is the most suitable type of radiation for this task?

..... (1)

(ii) Give a reason for your choice of radiation.

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

(b) Give two safety precautions that should be taken by the people carrying out the measurements.

1
.....
2
..... (2)

(c) The source is replaced when its activity falls to one quarter of its original value. If the half-life of this source is 5.5 years, calculate how often it will need to be replaced. Show your working.

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

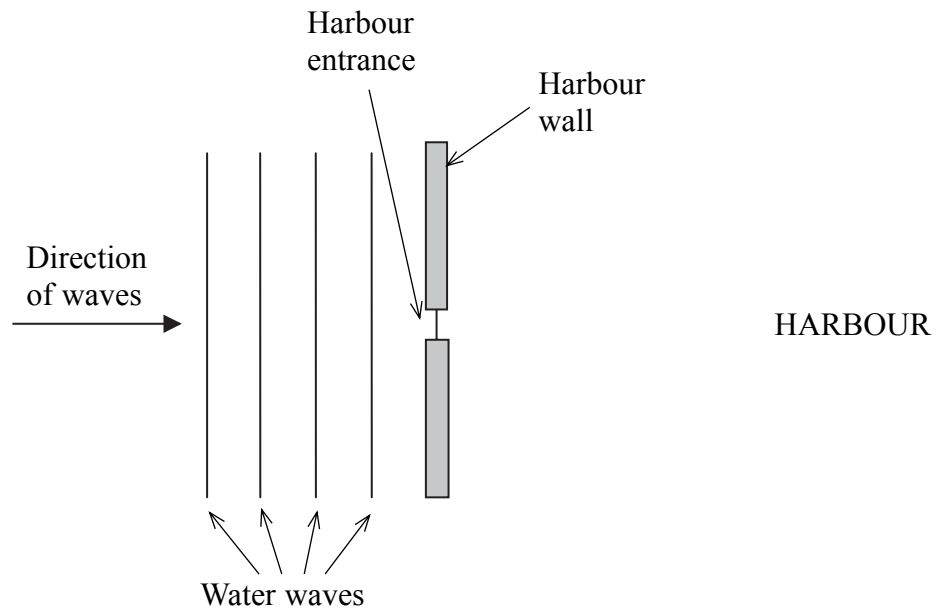
(Total 6 marks)

Q9



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10. The diagram shows a series of water waves moving towards a harbour wall and entrance.



(a) Add three more lines to the diagram to show the appearance of the waves after they have passed through the harbour entrance. (2)

(b) Are water waves transverse or longitudinal?
..... (1)

(c) Calculate the wavelength of the water waves outside the harbour if the wave speed is 4.0 m/s and the frequency is 0.80 Hz.
.....
.....
..... (2)

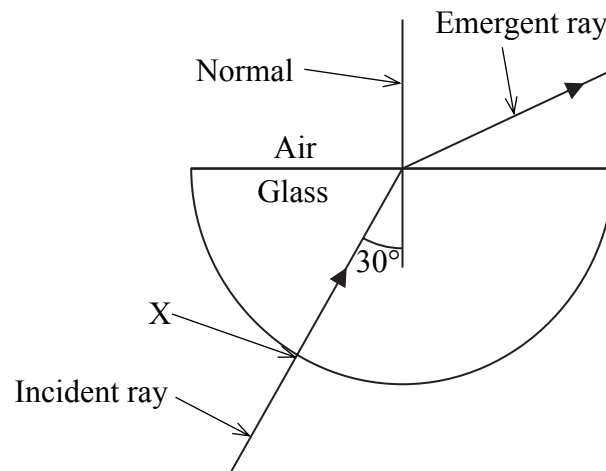
(d) The depth of the water inside the harbour is the same as that outside the harbour. What effect, if any, will there be on the wave speed and wavelength inside the harbour?
Wave speed
Wavelength (2)

(Total 7 marks)

Q10



11. The diagram shows a ray of light passing through and out of a semi-circular glass block.



(a) Give a reason why the incident ray does not change direction as it enters the glass block at X.

.....

 (1)

(b) The ray makes an angle of 30° with the normal at the straight face of the block. If the refractive index of this glass is 1.8, calculate the angle between the emergent ray and the normal.

.....

 (3)

(c) Show, by calculation, that when the angle that the incident ray makes with the straight face is increased to 35° total internal reflection occurs.

.....

 (2)

(Total 6 marks)

Q11

TOTAL FOR PAPER: 70 MARKS

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