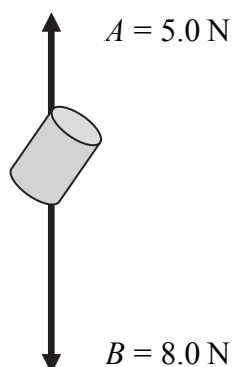


Answer ALL the questions.

1. The diagram shows an object falling through air. The object is acted on by two forces *A* and *B* whose directions are shown by the arrows. The value of each force is shown.



- (a) Name the type of force represented by:

(i) *A* **(1)**

(ii) *B* **(1)**

- (b) Give **two** reasons why the forces *A* and *B* are not a Newton's Third Law pair.

1

2
 **(2)**

- (c) State the size and direction of the resultant of forces *A* and *B*.

Size **(1)**

Direction **(1)**

- (d) The mass of the falling object is 6.0 kg. Calculate its acceleration.

.....

 **(2)**



(e) After some time the object falls with a steady speed. Draw an arrow on the diagram below to show the direction of each of the two forces acting on the object. Next to each arrow write the value of the force that it represents.



(2)

(Total 10 marks)

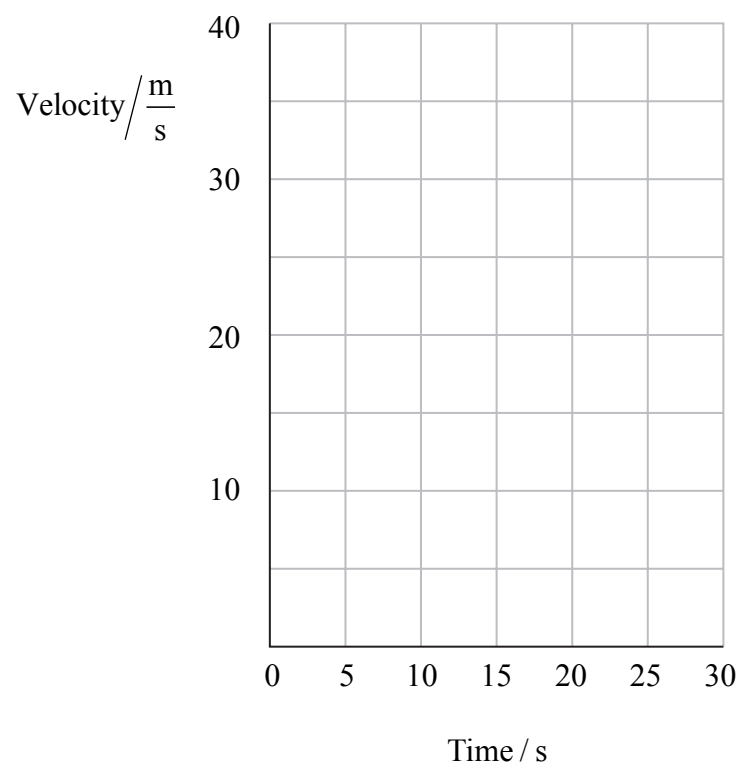
Q1

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2. (a) A train moves with a constant velocity of 30 m/s for 10 s before decelerating uniformly to rest in a further 15 s.
Draw a velocity–time graph on the axes below.



(2)

- (b) State the property of a velocity–time graph that can be used to determine the distance travelled by the train.

.....
(1)

- (c) Calculate the distance travelled by the train.

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

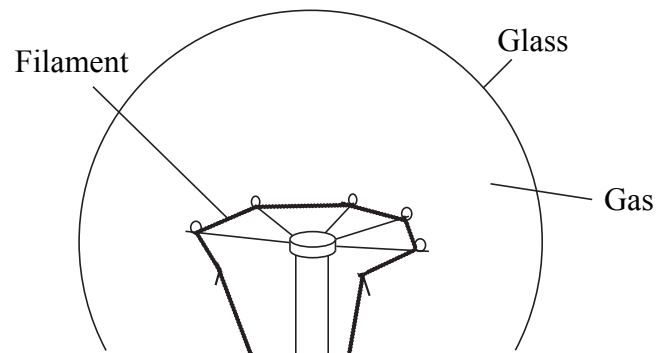
(Total 6 marks)

Q2



Leave blank

3. (a) The diagram shows part of a light bulb.



In normal operation the heat produced by the filament is transferred by convection. Explain the process of convection.

.....

.....

.....

.....

.....

(3)

(b) Light bulbs eventually fail when the filament evaporates. Experiments in 'weightless' conditions show that light bulbs fail sooner than they do in normal conditions. Explain why this is so.

.....

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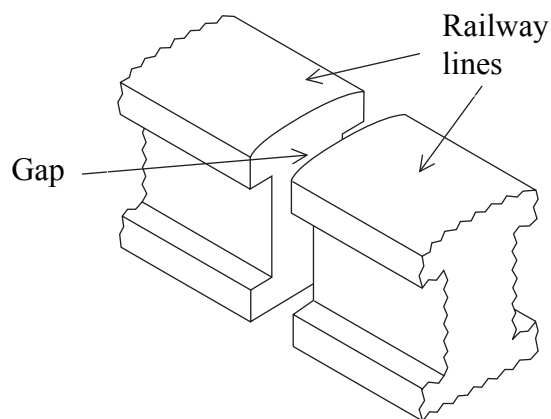
(2)

(Total 5 marks)

Q3



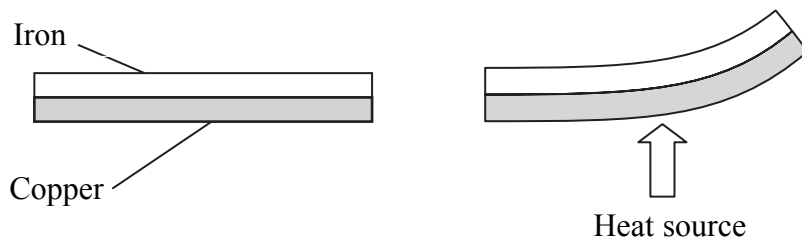
4. (a) The diagram shows two steel railway lines and the gap between them.



Explain why the gap becomes smaller as the temperature of the railway lines increases.

.....
(1)

(b) In the diagram below a bimetallic strip, made of iron and copper welded together, bends when heated.



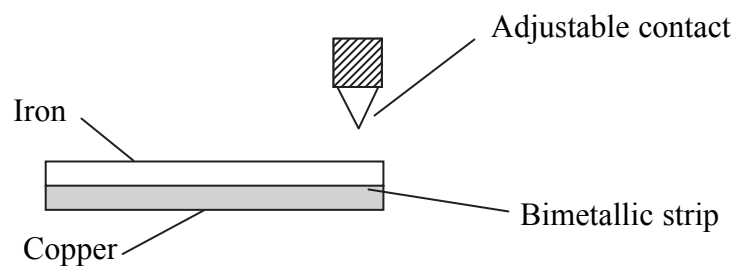
Explain why the strip bends upwards as shown.

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



Leave blank

- (c) The diagram shows part of an electric heater where a bimetallic strip controls the heater temperature. The adjustable contact can be moved vertically up or down. When the bimetallic strip touches the adjustable contact the heater switches off.



To increase the temperature setting of the heater, should the adjustable contact be moved up or down?

.....

(1)

Q4

(Total 4 marks)

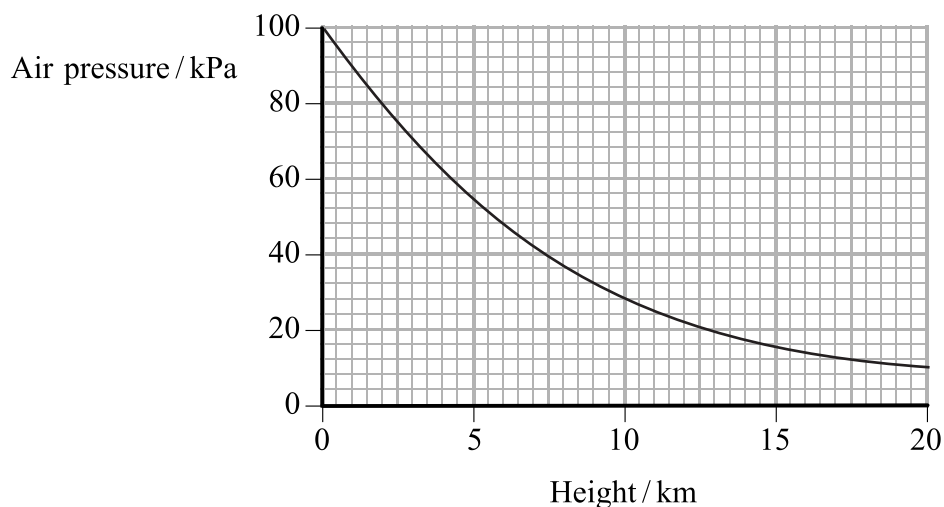


5. (a) A plastic bag contains air. What causes the air molecules to exert a pressure on the inside of the bag?

.....

(2)

(b) The graph shows how air pressure varies with height.



A mountaineer on the top of Mount Everest seals some air in a plastic bag. The volume of the plastic bag is 0.00060 m^3 . The height of Mount Everest is 9.0 km .

(i) What is the air pressure at a height of 9.0 km ?

.....

(1)

(ii) The air pressure at sea level is 100 kPa . Calculate the volume of the plastic bag when the mountaineer returns to sea level.

.....

(2)

(iii) State **two** assumptions that you have made in your calculation.

1

2

(2)

(Total 7 marks)

Q5



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blank

6. The Sun emits huge numbers of protons which travel at high speeds in all directions. Some of these protons travel towards the Earth.

(a) What is meant by the term **electric current**?

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

(b) Why does the movement of these protons result in a current between the Earth and the Sun?

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

(c) The SOHO space satellite travels in an orbit between the Earth and the Sun. One of its instruments measures the charge passing through each square metre of space. On one occasion $5.40 \times 10^{-6} \text{ C}$ passes in one minute.

Calculate the average current passing through each square metre of space during this one minute.

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

(d) On another occasion the activity of the Sun increases and the speed of these protons doubles. What effect, if any, will this have on the current measured by the SOHO satellite?

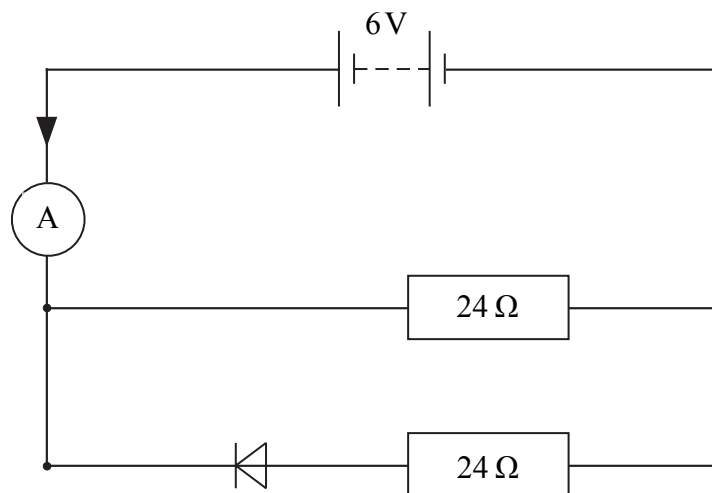
.....
.....
.....
(2)

(Total 6 marks)

Q6



7. Two identical resistors and a diode are connected as shown in the circuit below.



(a) What assumption can be made about the resistance of the diode when it is connected as shown?

..... (1)

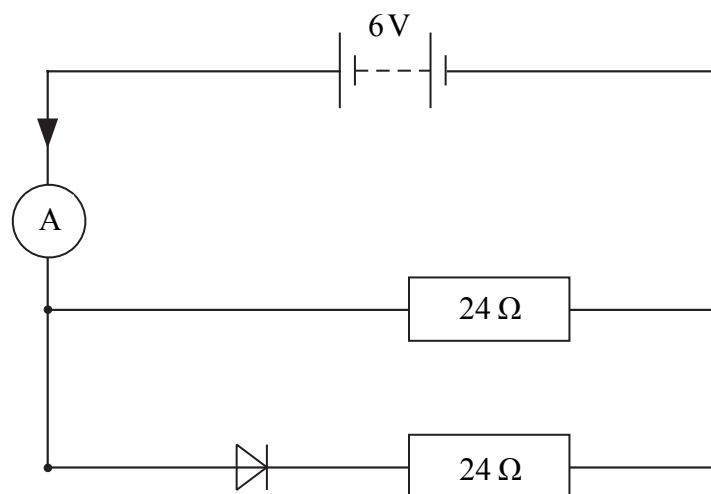
(b) Show, by calculation, that the reading on the ammeter is 0.25 A.

.....

 (1)



(c) The diode is reversed as shown in the circuit below. The reading on the ammeter is now 0.45 A.



(i) What is the current through the diode?

..... (1)

(ii) Calculate the resistance of the diode when connected in this circuit. Show your working.

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

(d) What effect does a diode have when connected in an a.c. (alternating current) circuit?

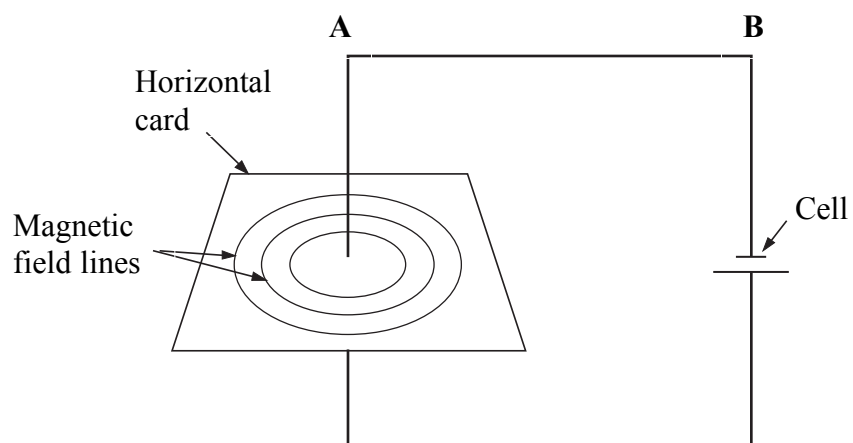
.....
..... (1)

(Total 7 marks)

Q7



8. The diagram shows a cell connected to a copper wire which passes vertically through a horizontal card. When the current is turned on, magnetic field lines are produced around the wire.



(a) (i) Add an arrow to the wire **AB** to show the direction of the conventional current. **(1)**

(ii) Add an arrow to one of the magnetic field lines to show the direction of the magnetic field. **(1)**

(b) (i) What is shown by the direction of a magnetic field line?

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

(ii) How can the shape and direction of one of the field lines on the horizontal card be demonstrated?

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

(Total 7 marks)

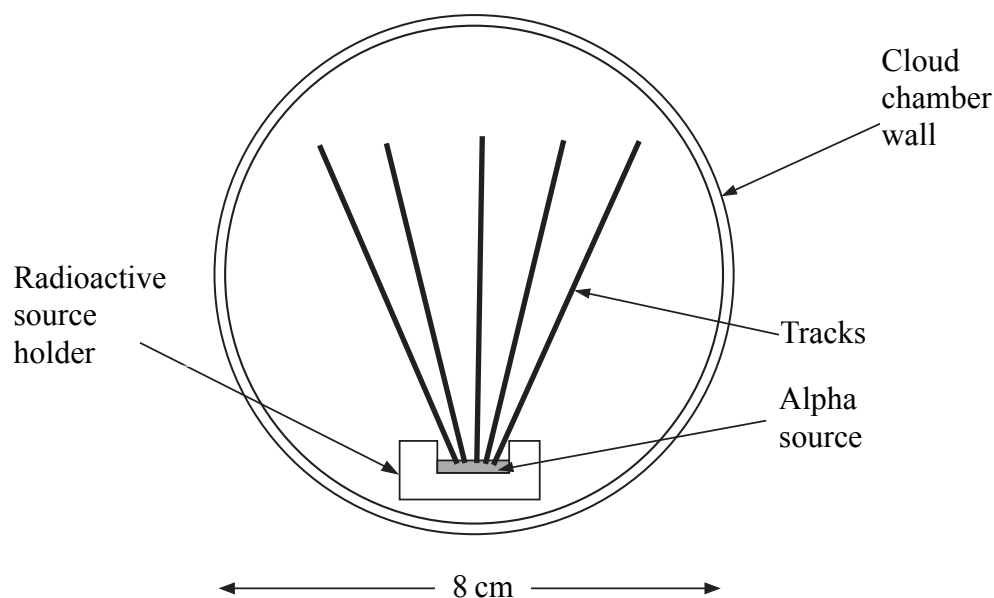
Q8



9. (a) Why is it not possible to see an alpha particle?

..... (1)

(b) The diagram shows the tracks produced by an alpha source placed in a cloud chamber.



(i) What are the tracks made from?

..... (1)

(ii) What property of radioactive particles is responsible for the production of the tracks?

..... (1)

(iii) List **two** features of the tracks shown that can be used to confirm that they were produced by alpha particles.

1

2

(2)

(c) Give **one** reason why this type of cloud chamber is unsuitable for observing the tracks of beta or gamma radiation.

.....

.....

(1)

(Total 6 marks)

Q9



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blank

10. Mars Express is an artificial satellite which orbits the planet Mars. A transmitter on the satellite sends radio waves vertically down towards the surface of Mars.

(a) (i) Are radio waves transverse or longitudinal?

.....
(1)

(ii) Calculate the wavelength of the radio waves used if the frequency is 5.0 MHz (5.0×10^6 Hz).

[Speed of radio waves = 3.0×10^8 m/s]

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

(b) The satellite transmits a short pulse of radio waves towards the surface. A reflection of the pulse returns to the satellite after 1.9 ms (1.9×10^{-3} s).

(i) Calculate the distance from the satellite to the surface of Mars.

[Speed of radio waves = 3.0×10^8 m/s]

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

(ii) Give a reason why a pulse transmitted a few minutes later takes longer than 1.9 ms to return to the satellite.

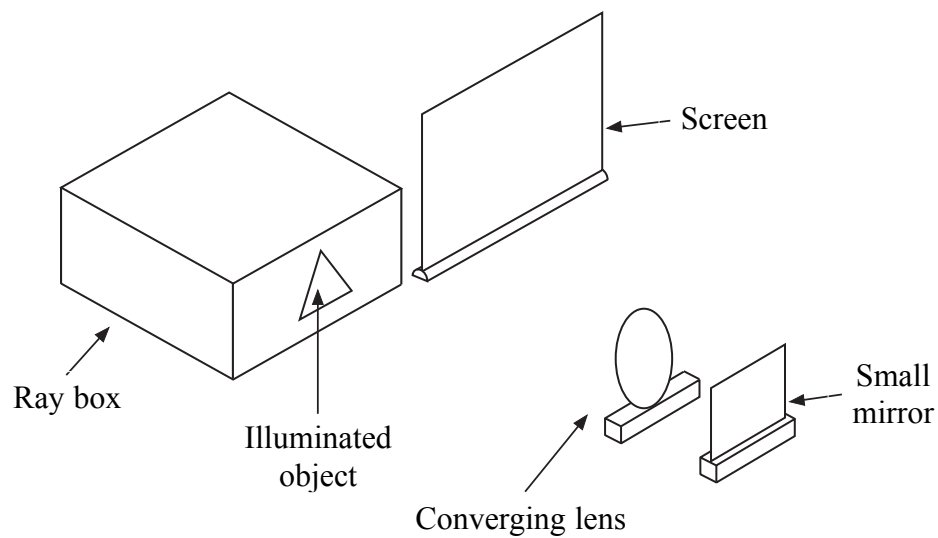
.....
.....
(1)

(Total 7 marks)

Q10



11. The diagram shows an arrangement that can be used to measure the focal length of a converging lens by making a single measurement. The screen is level with the front of the ray box.



(a) Describe the adjustment needed before making the measurement.

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

(2)

(b) What is the single measurement needed?

.....
.....

(1)

(c) The image produced on the screen is real. List two other properties of this image.

1

2

(2)

Q11

(Total 5 marks)

TOTAL FOR PAPER: 70 MARKS

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