

Mixed Exercise 1

1.

Fig. 10.1 is part of the decay curve for a sample of a β -emitting isotope.

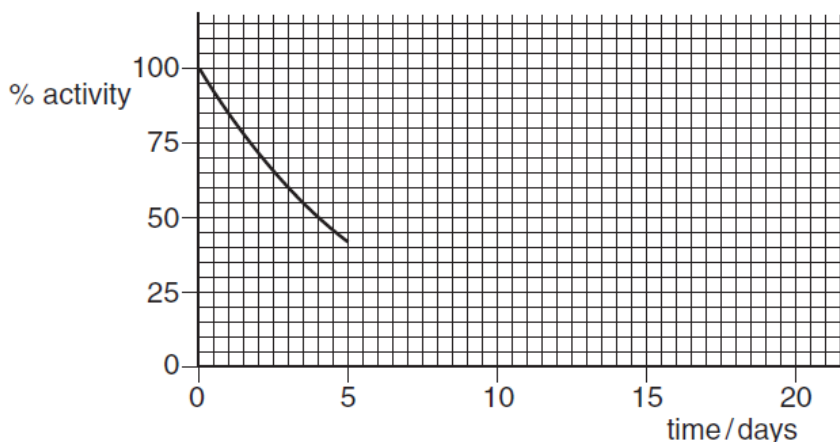


Fig. 10.1

(a) Use Fig. 10.1 to find the half-life of the isotope.

half-life = [1]

(b) Complete Fig. 10.1 as far as time = 20 days, by working out the values of a number of points and plotting them. Show your working. [2]

(c) The decay product of the β -emitting isotope is not radioactive. Explain why the sample of the radioactive isotope will be safer after 20 days than after 1 day. Support your answer by reference to the graph.

.....
[1]

(d) The isotope used for this decay curve may be represented by the symbol A_ZX . Write down an equation, by filling in the gaps below, to show the β -decay of this isotope to a decay product that has the symbol Y.



2.

- (a) Two horizontal strings are attached to a soft rubber ball, as shown in Fig. 2.1.

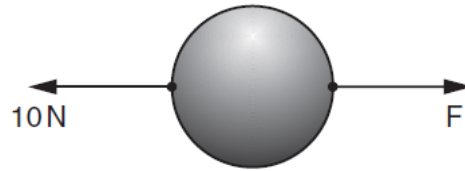


Fig. 2.1

A force of 10 N pulls on one string.

- (i) The ball does not move. What is the value of the force F on the other string?

F = N

- (ii) What change to the rubber ball do the two forces cause?

.....
[2]

- (b) A garden pot containing soil weighs a total of 360 N. The pot rests on three equally-spaced blocks, so that surplus water can drain out of the holes in the base of the pot. The soil is uniformly distributed in the pot. The pot is shown in Fig. 2.2.

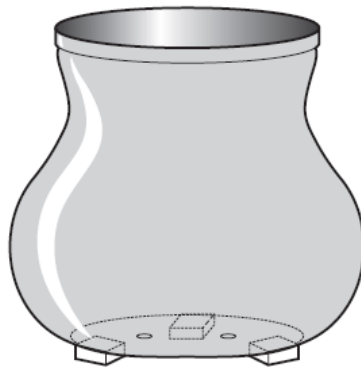


Fig. 2.2

- (i) What is the force exerted by each block on the pot?N

- (ii) State the direction of these forces.

.....

- (iii) The gardener finds that the blocks sink into the ground, but he must have the pot up on blocks to allow the drainage. What can he do to reduce the sinking of the pot?

.....

[3]

3.

The speed of sound in air is 340 m/s.

- (a) Complete Fig. 7.1 to show how far a sound wave has travelled 2, 3, 4 and 5 seconds after the sound was made. [1]

time elapsed/s	0	1	2	3	4	5
distance travelled/m	0	340				

Fig. 7.1

- (b) On Fig. 7.2, draw the graph of distance travelled against time for the sound wave. [3]

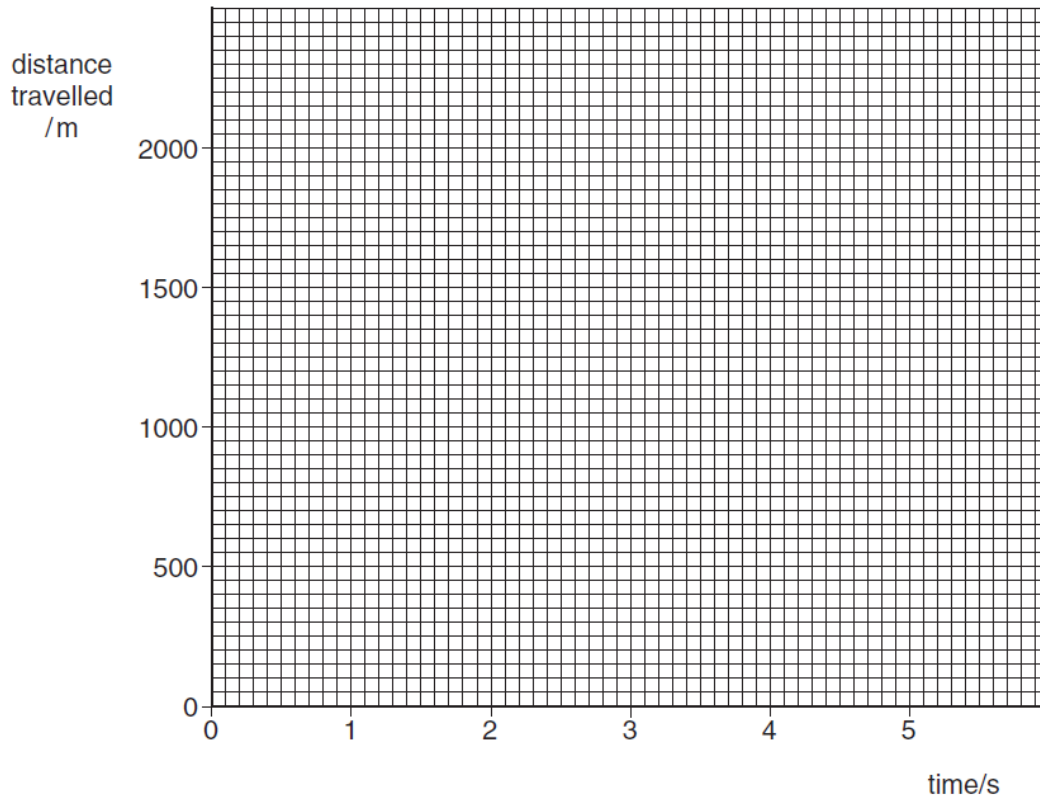


Fig. 7.2

- (c) A ship is sinking in the dark as shown in Fig. 7.3.



Fig. 7.3

The sailors on the ship fire a distress flare into the air. It explodes with a bang and a bright flash of light.

- (i) A lifeboat crew hear the bang and see the flash, but not at the same time. State which reaches the lifeboat first, the bang or the flash, and give a reason.

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

- (ii) The time interval in (c)(i) is 4.2 s. Use your graph in (b) to find how far away the lifeboat is from the flare. Show clearly on your graph how you got your answer.

distance of lifeboat = m
[6]

4.

The speed of a cyclist reduces uniformly from 2.5 m/s to 1.0 m/s in 12 s.

- (a) Calculate the deceleration of the cyclist.

deceleration = [3]

- (b) Calculate the distance travelled by the cyclist in this time.

distance = [2]

5.

In a thunderstorm, both light and sound waves are generated at the same time.

- (a) How fast does the light travel towards an observer?

speed = [1]

- (b) Explain why the sound waves always reach the observer after the light waves.

..... [1]

- (c) The speed of sound waves in air may be determined by experiment using a source that generates light waves and sound waves at the same time.
- (i) Draw a labelled diagram of the arrangement of suitable apparatus for the experiment.

(ii) State the readings you would take.

.....

.....

.....

(iii) Explain how you would calculate the speed of sound in air from your readings.

.....

.....

[4]

6.

(a) A radioactive isotope emits only α -particles.

(i) In the space below, draw a labelled diagram of the apparatus you would use to prove that no β -particles or γ -radiation are emitted from the isotope.

(ii) Describe the test you would carry out.

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

(iii) Explain how your results would show that only α -particles are emitted.

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

[6]

(b) Fig. 11.1 shows a stream of α -particles about to enter the space between the poles of a very strong magnet.

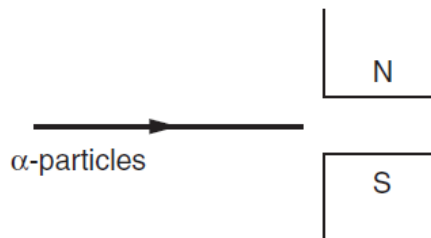


Fig. 11.1

Describe the path of the α -particles in the space between the magnetic poles.

.....
.....
.....[3]

7.

(a) Here are three quantities that are associated with waves in the electromagnetic spectrum.

speed, wavelength, frequency

(i) Which of these is the same in a vacuum for both X-rays and radio waves?

.....

(ii) Which of these determines the colour of a ray of light?

.....

(iii) Which of these is the distance between two successive wavecrests?

..... [3]

(b) Which region of the electromagnetic spectrum has the shortest wavelength?

..... [1]

8.

Fig. 1.1 shows the speed-time graph for a bus during tests.

At time $t = 0$, the driver starts to brake.

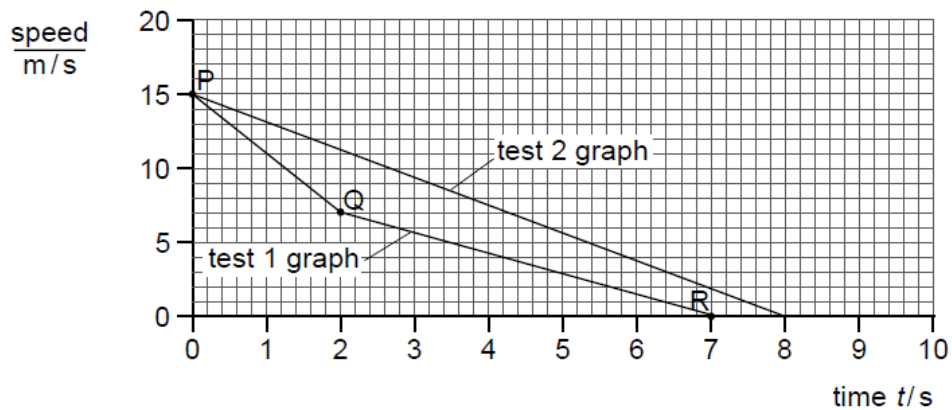


Fig. 1.1

(a) For test 1,

(i) determine how long the bus takes to stop,

.....

(ii) state which part of the graph shows the greatest deceleration,

.....

(iii) use the graph to determine how far the bus travels in the first 2 seconds.

distance = [4]

(b) For test 2, a device was fitted to the bus. The device changed the deceleration.

(i) State two ways in which the deceleration during test 2 is different from that during test 1.

1

2

(ii) Calculate the value of the deceleration in test 2.

deceleration =

[4]

(c) Fig. 1.2 shows a sketch graph of the magnitude of the acceleration for the bus when it is travelling around a circular track at constant speed.

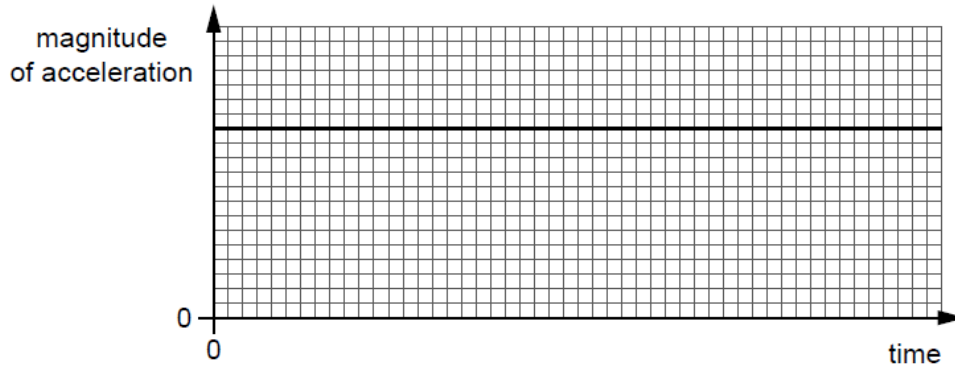


Fig. 1.2

(i) Use the graph to show that there is a force of constant magnitude acting on the bus.

.....
.....

(ii) State the direction of this force.

.....

[3]