# Forces and Motion 2 chpt 1 - 4 Revision

1) **(a)** Figs. 1.1 and 1.2 show speed-time graphs for two objects, each moving in a straight line.

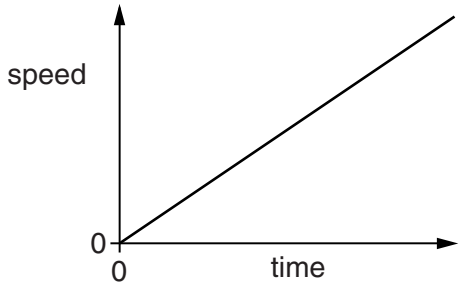



**Fig. 1.1**

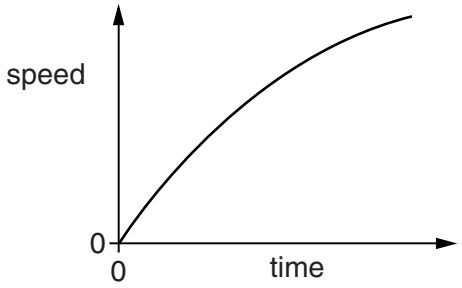



**Fig. 1.2**

**(i)** Describe the motion of the object shown by the graph in Fig. 1.1.

.....

.....

**(ii)** Describe the motion of the object shown by the graph in Fig. 1.2.

.....

.....

[3]

**(b)** On a day with no wind, a large object is dropped from a tall building. The object experiences air resistance during its fall to the ground.

State and explain, in terms of the forces acting, how the acceleration of the object varies during its fall.

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 7]

2) An experiment is carried out to find the acceleration of free fall.

A strip of paper is attached to a heavy object. The object is dropped and falls to the ground, pulling the paper strip through a timer. The timer marks dots on the paper strip at intervals of 0.020 s.

Fig. 1.1 shows a section of the paper strip with the first three dots marked. The first dot on the paper strip, labelled A, is marked at the instant the object is dropped.

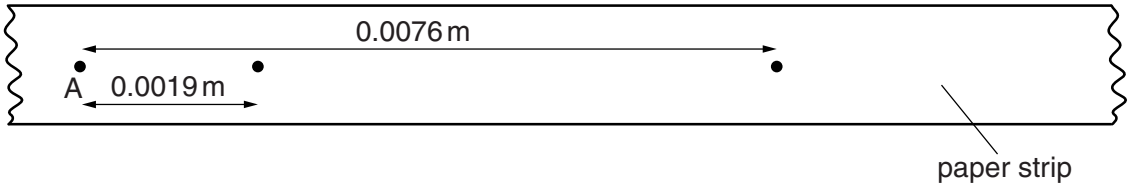



**Fig. 1.1** (not to scale)

**(a)** State how the dots on the paper strip show that the object is accelerating.

.....

.....[1]

**(b)** Calculate the average speed of the object

**(i)** in the first 0.020 s after the object is dropped,

average speed = .....

**(ii)** in the second 0.020 s after the object is dropped.

average speed = .....
[3]

**(c)** Use the results from **(b)** to calculate the acceleration of the falling object.

acceleration = .....[3]

[Total: 7]

3) At a sports event, a champion runner and a car take part in a race.

**(a)** The runner runs at a constant speed of 10 m/s from the start of the race. During the first 5.0 s of the race, the car's speed increases from 0 m/s to 25 m/s at a uniform rate.

On Fig. 1.1, draw

**(i)** a graph to show the motion of the runner, [1]

**(ii)** a graph to show the motion of the car.

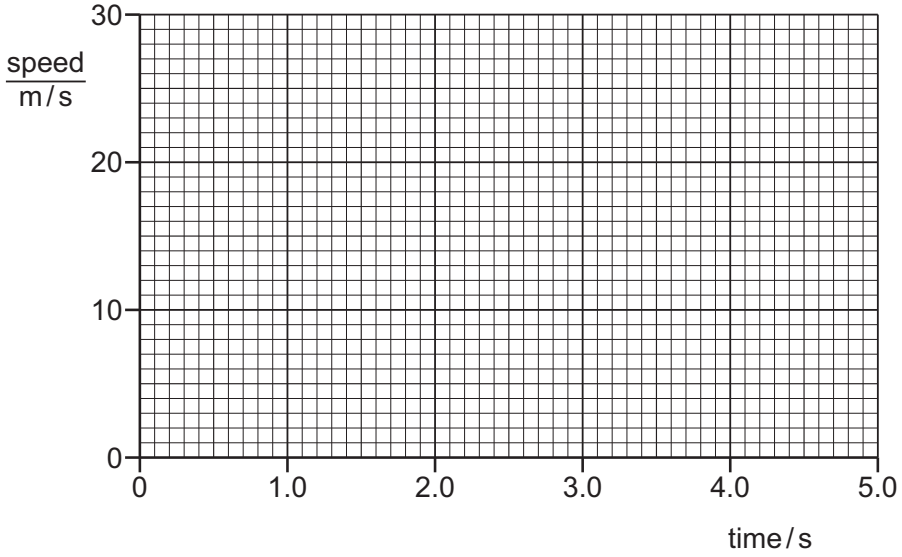



**Fig. 1.1**

[1]

**(b)** Use your graphs to determine

**(i)** the distance travelled by the runner in the 5.0 s,

distance = .....[1]

**(ii)** the distance travelled by the car in the 5.0 s,

distance = .....[2]

**(iii)** the time at which the car overtakes the runner.

time = .....[2]

[Total: 7]

4) Fig. 1.1 shows a rocket-powered sled travelling along a straight track. The sled is used to test components before they are sent into space.

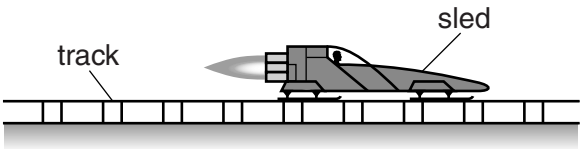
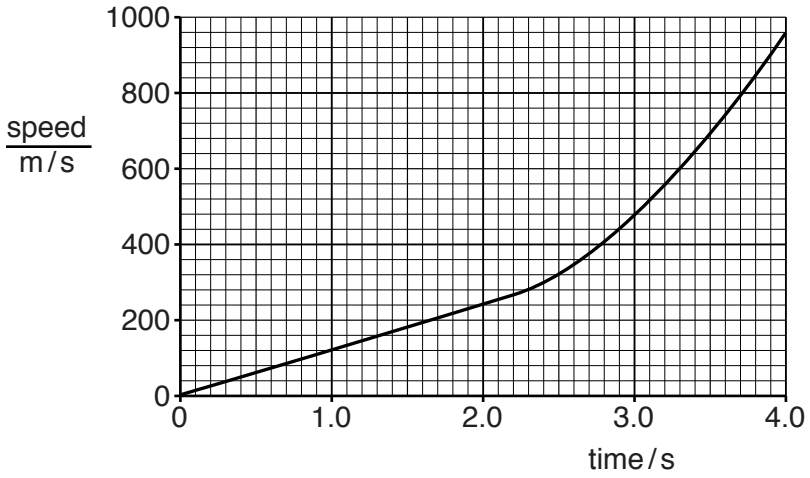



Fig. 1.2 is the speed-time graph for the sled from time $t = 0$ s.




**(a)** On Fig. 1.2, mark a point labelled P to indicate a time when the acceleration of the sled is not constant. [1]

**(b)** **(i)** Calculate the acceleration of the sled at $t = 1.0$ s.

acceleration = .....[2]

**(ii)** Determine the distance travelled by the sled between $t = 1.0$ s and $t = 2.0$ s.

distance = .....[2]

**(c)** The resultant force acting on the sled remains constant during the test.

Suggest why the acceleration of the sled is not constant.

.....

.....[1]

[Total: 6]

5)

**(a) (i)** Mass is a scalar quantity.

State another scalar quantity.

.....

**(ii)** Force is a vector quantity.

State another vector quantity.

.....

[2]

**(b)** A boat is floating on still water.

The mass of the boat is 290 000 kg. A resultant force of 50 kN acts on the boat.

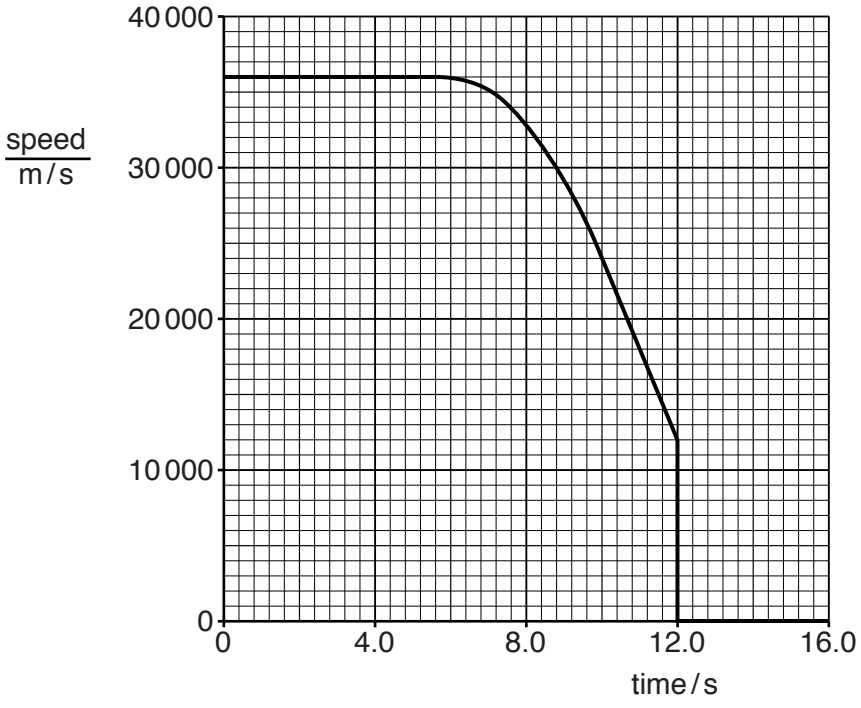
Calculate the acceleration of the boat.

acceleration = .....[3]

6)

A comet, travelling in space, enters the atmosphere of a planet.

Fig. 1.1 is the speed-time graph for the comet from time $t = 0$ s.



6 cont)

**(a)** **(i)** During the period $t = 0\,s$ to $t = 6.0\,s$, both the speed of the comet and the velocity of the comet remain constant.

State what this suggests about the motion of the comet.

.....

.....[1]

**(ii)** Determine the distance travelled during the period $t = 0\,s$ to $t = 6.0\,s$.

distance = .....[2]

**(b)** Explain what the graph shows about the motion of the comet during the period $t = 6.0\,s$ to $t = 10.0\,s$.

.....

.....

.....[2]

**(c)** Determine the acceleration of the comet at $t = 11.0\,s$.

acceleration = .....[2]

**(d)** Suggest what happens to the comet at $t = 12.0\,s$.

.....

.....[1]

[Total: 8]

7) A plastic ball is dropped from the balcony of a tall building and falls towards the ground in a straight line.

Fig. 1.1 is the speed-time graph for the falling ball.

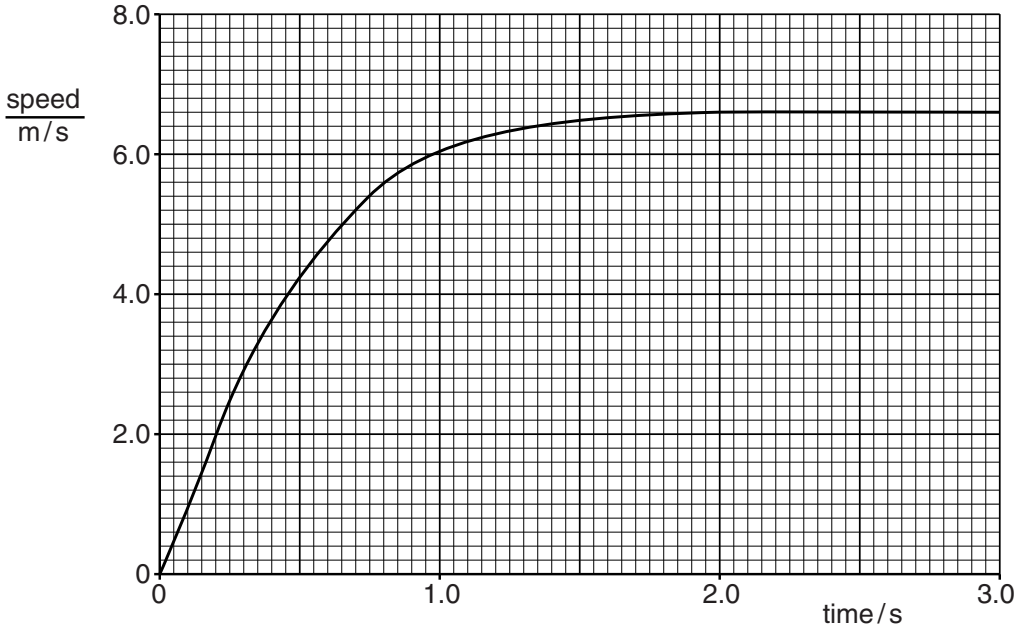



**Fig. 1.1**

**(a)** State and explain, in terms of forces, what is happening to the speed of the ball between time $t = 2.0\,s$ and $t = 3.0\,s$.

.....

.....

.....[2]

**(b)** On Fig. 1.1, mark a point P on the line where the acceleration of the ball is not constant. [1]

**(c)** Using Fig. 1.1,

**(i)** calculate the acceleration of the ball between $t = 0\,s$ and $t = 0.25\,s$,

acceleration = .....[2]

**(ii)** estimate the distance that the ball falls in the first 3.0 s.

distance = .....[2]

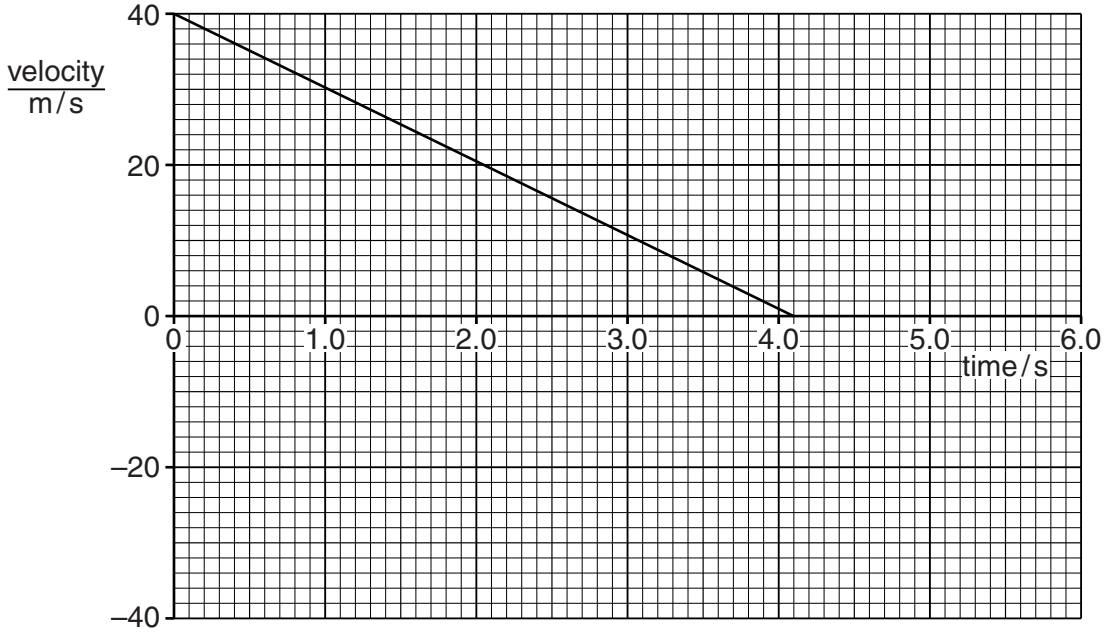
[Total: 7]

8) **(a)** Underline the vectors in the following list of quantities.

density energy force mass velocity volume [2]

**(b)** A small metal ball is projected into the air with a velocity of 40 m/s vertically upwards.

The graph in Fig. 2.1 shows how the velocity changes with time until the ball reaches its maximum height.




Use the graph to find,

**(i)** the time at which the ball reaches its maximum height,

time = .....[1]

**(ii)** the deceleration of the ball,

deceleration = .....[2]

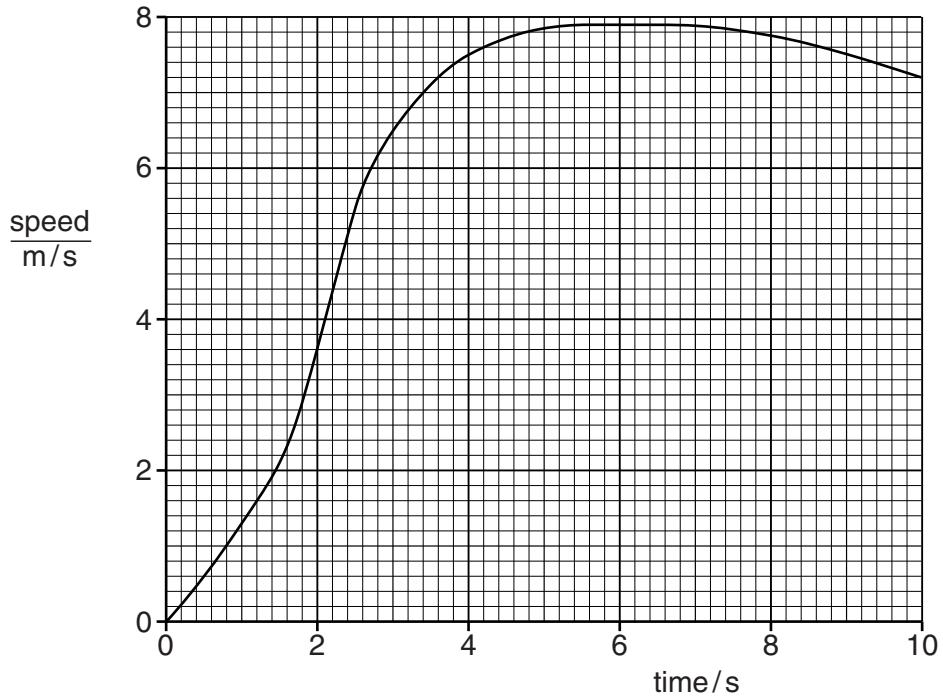
**(iii)** the maximum height reached by the ball.

maximum height = .....[2]

**(c)** On Fig. 2.1, add a line to the graph to show how the velocity of the ball changes after it reaches its maximum height. Your line should extend to time 6.0 s. [1]

[Total: 8]

9) A school athlete does a sprint training run. Fig. 1.1 shows how her speed varies with time.




**(a)** Explain how the graph in Fig. 1.1 can be used to determine the distance she runs.

.....

.....[1]

**(b)** Determine her maximum acceleration. Show clearly on the graph how you obtained the necessary information.

maximum acceleration = .....[4]

**(c)** She runs a distance of 62 m.

Calculate her average speed.

average speed = .....[2]

[Total: 7]