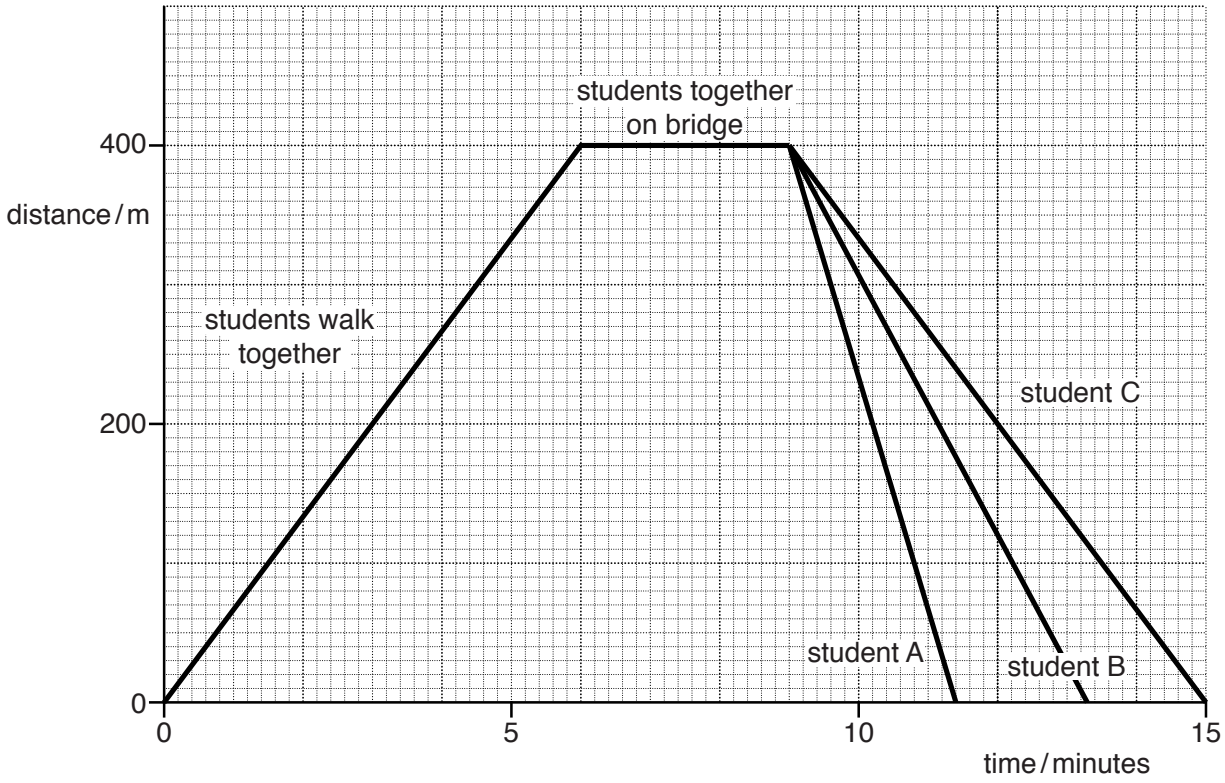
Forces and Motion 1 chpt 1 - 4 Revision

1) Three students walk together from school to a bridge. The students stand together on the bridge for three minutes and then return separately to school.

The distance-time graphs for student A, student B and student C are shown in Fig. 2.1.



(a) (i) Determine the distance from the school to the bridge.

distance = ... m [1]

(ii) Calculate the average speed of the students when they are walking to the bridge. Give your answer in m / s.

average speed = ... m / s [4]

(b) The students return to school at different speeds. One student walks slowly, one student walks quickly and the other student runs.

State which student runs. Explain how this is shown by the graph.

student .....

explanation .....

.....[2]

[Total: 7]

2) Fig. 1.1 shows part of the speed-time graphs for a cyclist and for a runner.

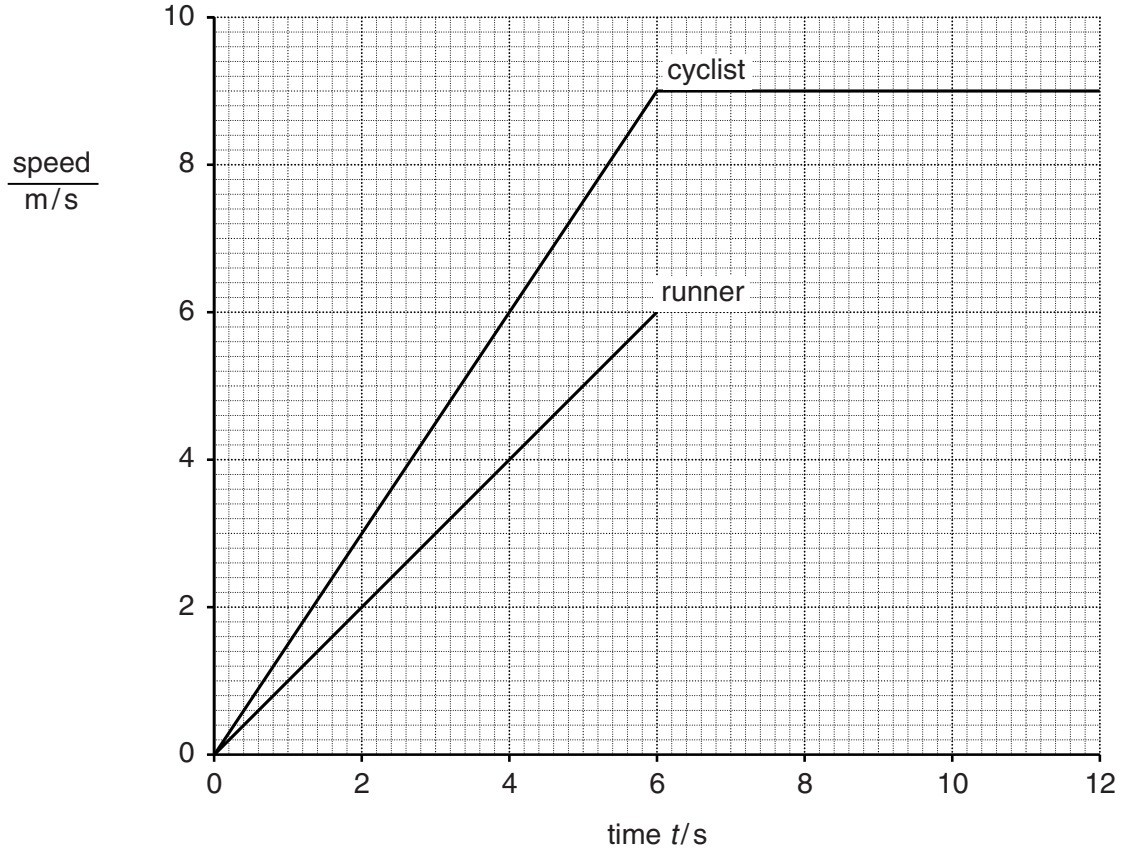


Fig. 1.1

(a) Compare the motion of the cyclist and the runner during the first 6 seconds. Explain your answer.

.....

.....

.....

.....[3]

(b) Describe the motion of the cyclist between time $t = 6.0\,s$ and time $t = 12.0\,s$.

.....[1]

(c) Calculate the total distance travelled by the cyclist between $t = 0$ and $t = 12.0\,s$.

distance travelled = ... m [4]

2 cont)

(d) After the first 6.0 seconds, the runner moves at constant speed for 4.0 seconds. He then slows down uniformly and stops in a further 2.0 seconds.

On Fig. 1.1, complete the graph for the runner's motion. [2]

[Total: 10]

3) A boy steps off a high board into a swimming pool.

Fig. 2.1 shows the forces acting on the boy at one point in his fall.

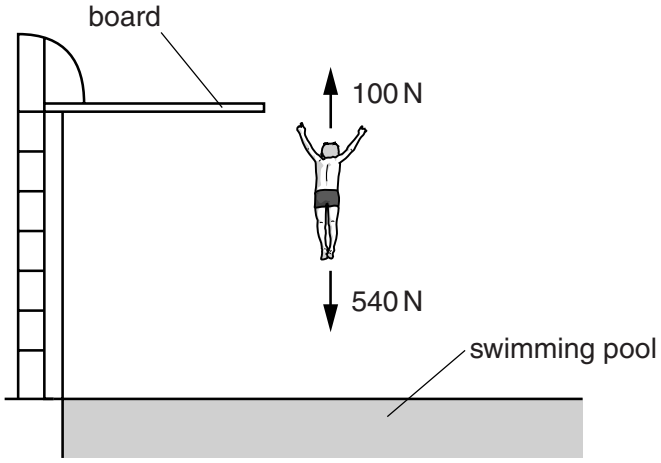


Fig. 2.1

(a) The 540 N force is caused by gravitational attraction.

State the cause of the 100 N force.

.....[1]

(b) Calculate the mass of the boy.

mass of boy = ... kg [2]

(c) Calculate the resultant force on the boy. State its direction.

resultant force = ... N

direction = ...
[2]

[Total: 5]

4) Fig. 2.1 shows the speed-time graph for a student cycling along a straight, flat road.

Fig. 2.1

(a) Calculate the distance he travels in the first 10 s.

distance = ... m [3]

(b) Fig. 2.2 shows three pairs of forces A, B and C.

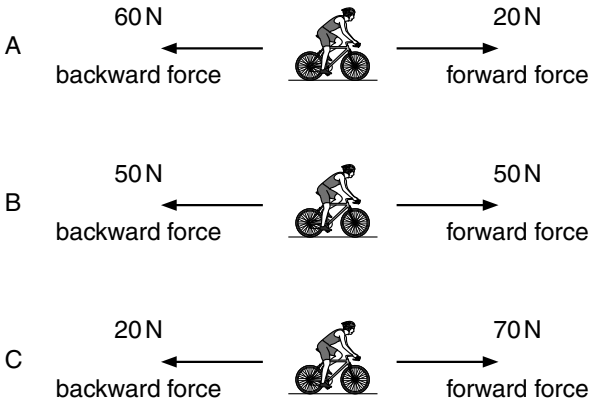


Fig. 2.2

Identify which pair of forces, A, B or C, acts on the cyclist between 11 s and 16 s. Explain your choice.

pair of forces .....

explanation .....

.....

.....

[3]

5) Fig. 1.1 shows how the speed of an object varies during a period of 30 s.

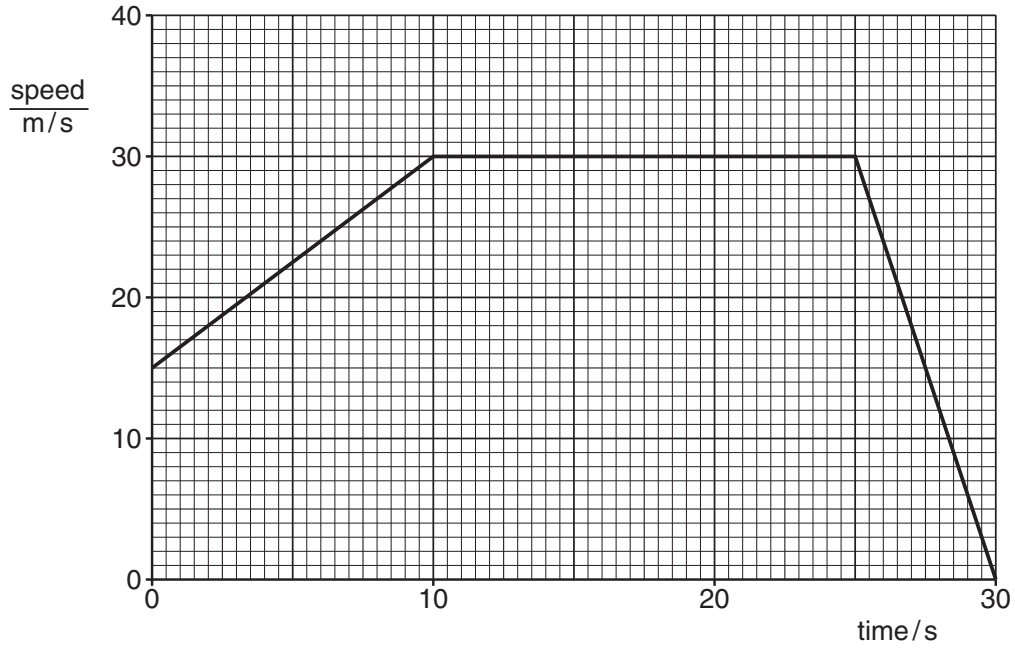


Fig. 1.1

(a) State the speed of the object

(i) at the start, time = 0 s,

speed = ... m/s

(ii) at the end, time = 30 s.

speed = ... m/s

[2]

(b) Describe what, if anything, is happening to the speed during the period 10 s to 25 s.

..... [1]

(c) Determine the distance travelled in the last 5 s.

distance = ... m [3]

(d) The total distance travelled during the 30 s is 750 m.

Calculate the average speed of the object during the 30 s.

average speed = ... m/s [3]

[Total: 9]

6) The car in Fig. 2.1 is on a level road.

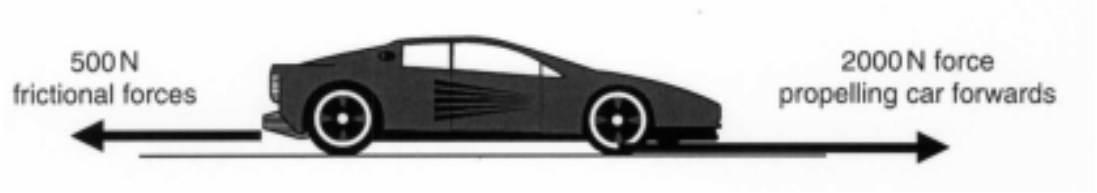


Fig. 2.1

(a) Calculate the magnitude of the resultant force on the car.

resultant force = ... N [1]

(b) Tick the box below that describes the motion of the car.

- ☐ travels forward at constant speed
- ☐ travels forward with increasing speed
- ☐ travels forward with decreasing speed
- ☐ travels backward at constant speed
- ☐ travels backward with increasing speed
- ☐ travels backward with decreasing speed
- ☐ remains at rest

[1]

(c) Later, the car is moving forwards and the frictional forces suddenly increase to 2500 N. The forwards force remains constant at 2000 N.

Describe and explain what happens to the car.

.....

..... [2]

(d) Suggest what might have caused the frictional forces in **(c)** to increase.

..... [1]

[Total: 5]

7) **(a)** A large stone, initially at rest, falls from the top of a building. The stone takes 3.2 s to fall to the ground. For this stone, air resistance can be ignored.

(i) Stating the formula that you use, show that the speed of the stone when it hits the ground is 32 m / s.

[1]

(ii) On Fig. 1.1, draw the speed-time graph for the fall of the stone. Label with an X the line on the graph. [1]

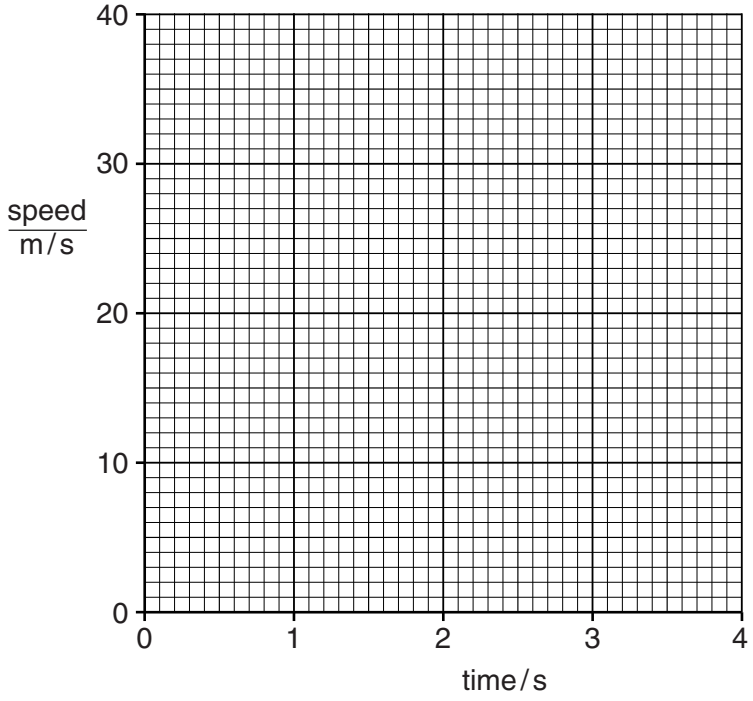


Fig. 1.1

(iii) Use the graph in **(ii)** to determine the height of the building.

height = ... [2]

(b) A smaller stone than the stone in **(a)** falls from the same building. This stone is affected by air resistance.

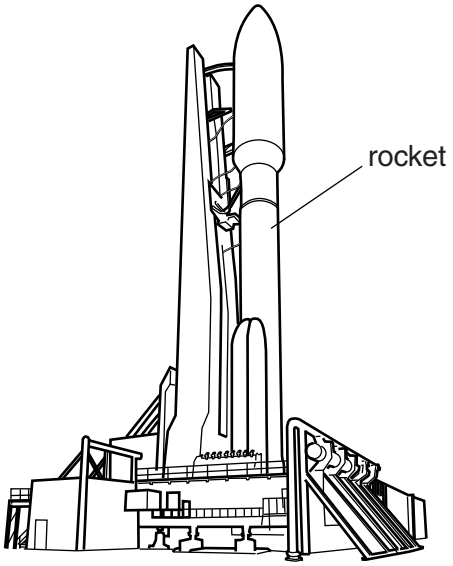
(i) What happens to the air resistance as the stone falls? Underline your choice of answer.

Air resistance decreases. Air resistance is constant. Air resistance increases. [1]

(ii) On Fig. 1.1, draw a possible speed-time graph for the fall of this stone. Label with a Y this line on the graph. [3]

[Total: 8]

8) The rocket shown in Fig. 2.1 is about to be launched.



The total mass of the rocket and its full load of fuel is 2.8×10^6 kg. The constant force provided by the rocket's motors is 3.2×10^7 N.

(a) Calculate

(i) the total weight of the rocket and the fuel,

weight = ... [1]

(ii) the resultant force acting on the rocket,

resultant force = ... [2]

(iii) the vertical acceleration of the rocket immediately after lift-off.

acceleration = ... [2]

(b) Suggest why the acceleration of the rocket increases as it rises above the Earth's surface.

.....

..... [1]

[Total: 6]