

1 A train travels with a constant velocity of 56 m/s on a horizontal track. The mass of the train is 440 000 kg.

(a) State the difference between the velocity of the train and its speed.

.....
 [1]

(b) Calculate the kinetic energy stored in the moving train.

kinetic energy = [2]

(c) (i) The train has a uniform deceleration of 1.2 m/s^2 .

Calculate the constant braking force which brings the train to rest.

force = [2]

(ii) Calculate the distance travelled by the train as it comes to rest.

distance = [3]

[Total: 8]

2 (a) A resultant force is applied to an object moving with a velocity v in a straight line.

(i) State **two** different changes to the motion that the resultant force may cause.

1
 2 [2]

(ii) State **one** other way that forces may change a stationary object.

..... [1]

(b) Describe how a uniform metre ruler, a pivot and a selection of masses can be used to demonstrate that there is no resultant moment on an object in equilibrium.

You may include a labelled diagram in your answer.

.....

 [4]

[Total: 7]

3 Fig. 3.1 shows a side view of part of a concrete track at a skateboard park.

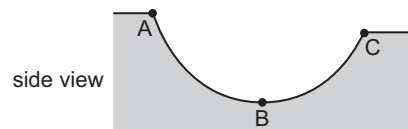


Fig. 3.1

- (a) A skateboarder is initially at rest at point A. The skateboarder then travels through point B and comes to rest at point C.

Describe the transfer of energy as the skateboarder travels from A to B to C along the concrete track.

.....

 [2]

- (b) (i) B is at ground level and C is at 2.8 m above ground level. The mass of the skateboarder is 65 kg.

Calculate the work done on the skateboarder as she travels from B to C.

work done = [2]

- (ii) The skateboarder falls off the skateboard at B. She hits the track and comes to rest after a few milliseconds.

State the equation that defines the force F with which the skateboarder hits the track. State the meaning of any symbols you use.

.....
 [2]

[Total: 6]

10 Jupiter and the Earth are planets in our Solar System.

- (a) Describe the composition of Jupiter and the Earth.

Jupiter
 the Earth [2]

- (b) The gravitational field strength at the surface of the Earth is approximately 9.8 N/kg . The gravitational field strength at the surface of Jupiter is approximately 23 N/kg .

- (i) Define gravitational field strength.

.....
 [2]

- (ii) State **one** factor which causes the difference between the gravitational field strength at the surface of Jupiter and the gravitational field strength at the surface of the Earth.

.....
 [1]

- (c) State and explain the difference between the orbital speed of Jupiter and the orbital speed of the Earth.

statement

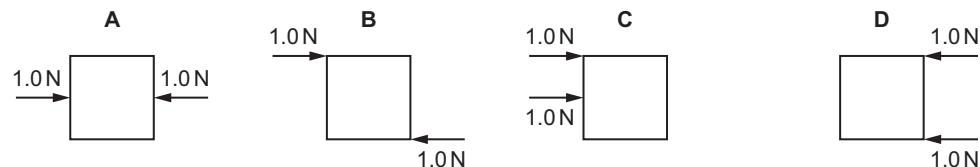
explanation

..... [3]

[Total: 8]

5 Four objects each have two forces acting on them.

Which object is in equilibrium?



- 1 Fig. 1.1 shows a straight section of a river where the water is flowing from right to left at a speed of 0.54 m/s .

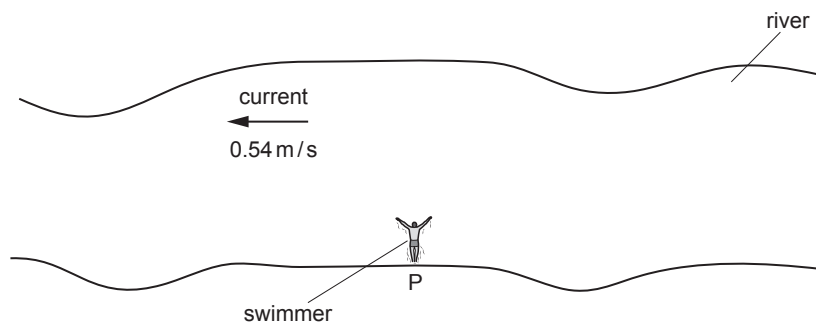


Fig. 1.1 (not to scale)

A swimmer starts at point P and swims at a constant speed of 0.72 m/s relative to the water and at right angles to the current.

- (a) (i) Determine, relative to the river bank, both the magnitude and direction of the swimmer's velocity.

magnitude of velocity =

direction of velocity

[4]

- (ii) After 1.5 minutes, the swimmer reaches point Q.

Calculate the distance between P and Q.

distance = [3]

- (b) When the swimmer is crossing the river, his actions produce a constant forward force on his body.

Explain why he moves at a constant speed.

.....

 [2]

[Total: 9]