Practise Test 3 Questions

Q1

A space rocket of mass 3×10^6 kg is launched from the earth's surface when its engine produces an upward thrust of 3×10^7 N. Calculate the rocket's acceleration at launch.

Q2

2 wooden blocks are tied together by piece of weightless string. One block (of mass 1.5 kg) sits on a horizontal table. There is no force of friction between the block and table. The other block (of mass 3 kg) is passed over a frictionless pulley. This block falls to the floor, dragging the 1.5 kg block across the table.

Calculate: (a) the acceleration of both wooden blocks;

(b) the tension (pulling force) in the string.

Q3

Adam pulls 2 metal blocks (both of mass 1.5 kg), joined by string of zero mass, along a horizontal bench top with a constant force of 36 N. The force of friction acting on each block is 15 N. Calculate: (a) the acceleration of the metal blocks;

(b) the tension (force) in the string between the 2 metal blocks.

Q4

The following examples relate to Elizabeth, mass 60 kg, who is standing on a set of scales in a lift.

Two forces act:

- Weight downwards (w)

  Value does not change.

- Reaction upwards (R)

  Value changes as motion of lift changes.

(R is the reading on the scales.)

Q4 continued

1) Lift cable breaks

Determine the reading on the scales (R) if the lift cable breaks, causing the lift, scales and Elizabeth to accelerate downwards at 9.8 m s^{-2}.

Q4 continued

2) Lift stationary

Determine the reading on the scales (R) if the lift is stationary.

Q4 continued

3) Lift travelling at constant velocity

Determine the reading on the scales (R) if the lift is travelling at constant velocity.

Q4 continued

4) Lift accelerating upwards

Calculate the reading on the scales (R) if the lift is accelerating upwards at 1.5 m s^{-2}.

Q4 continued

5) Lift accelerating downwards

Calculate the reading on the scales (R) if the lift is accelerating downwards at 1.5 m s^{-2}.

Q4 continued

6) Lift decelerating upwards

Calculate the reading on the scales (R) if the lift is decelerating upwards at 1.5 m s^{-2}.

Q4 continued

7) Lift decelerating downwards

Calculate the reading on the scales (R) if the lift is decelerating downwards at 1.5 m s^{-2}.

Q5

A **2 kg** trolley moving to the **right** at **10 m s^{-1}** collides with a **10 kg** trolley which is also moving to the **right** at **1 m s^{-1}**.

Immediately **after** the collision, the **2 kg** trolley rebounds to the left at **5 m s^{-1}**.

(a) Calculate the **velocity** of the **10 kg** trolley immediately **after** the collision.

(b) Show that the collision is **elastic**.

Q6

Calculate the impulse a force of 5 N exerts on an object which it pushes for 3 seconds.

Q7

A ball of mass 0.2 kg is thrown against a brick wall. The ball is travelling horizontally to the right at 3 ms^{-1} when it strikes the wall. It rebounds horizontally to the left at 2.5 ms^{-1}.

(a) Calculate the ball's change in velocity.

(b) Calculate the ball's change in momentum.

(c) What is the impulse the wall exerts on the ball?

Q8

A golf ball of mass 0.1 kg, initially at rest, was hit by a golf club, giving it an initial horizontal velocity of 50 m s^{-1}. The club and ball were in contact for 0.002 seconds.

Calculate the **average force** which the club exerted on the ball.

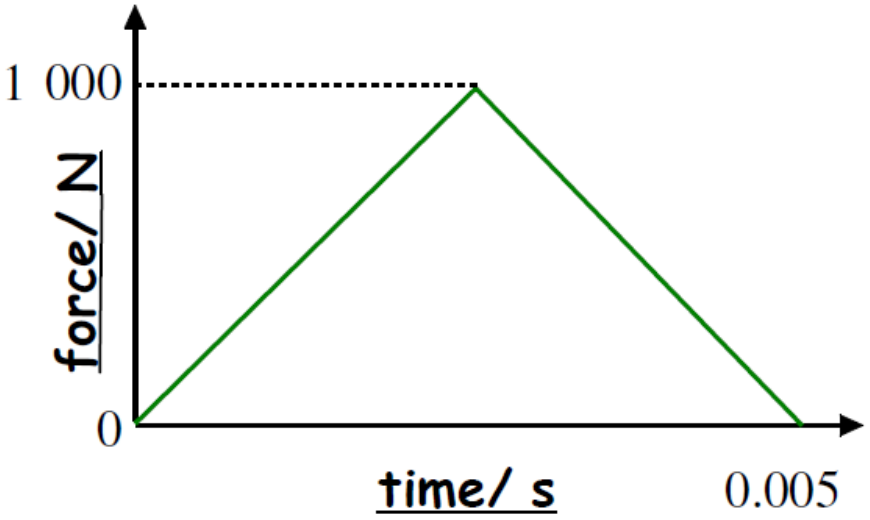
Q9

A ball of mass 0.2 kg is initially at rest. It is acted upon by a changing force, as shown on the graph below.

Determine: (a) the impulse the force gives to the ball;

(b) the change in momentum of the ball;

(c) the velocity of the ball once the force has acted on it.



Q10

A motorcycle being driven on a dirt path hits a rock. Its 60-kilogram cyclist is projected over the handlebars at 20 meters per second into a haystack. If the cyclist is brought to rest in 0.50 seconds, the magnitude of the average force exerted on the cyclist by the haystack is

Q11

A 2-kilogram body is initially traveling at a velocity of 40 meters per second east. If a constant force of 10 newtons due east is applied to the body for 5 seconds, the final speed of the body is

Q12

A tow-truck applies a force of 2000N on a 2000-kg car for a period of 3 seconds.

(A) What is the magnitude of the change in the car's momentum?

(B) If the car starts at rest, what will be its speed after 3 seconds?