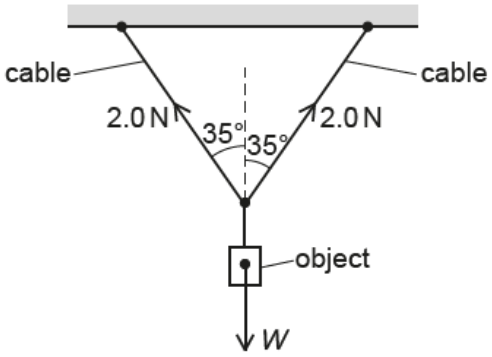
Forces in action – 2021/20 GCE Physics A Component 01

1. Nov/2021/Paper_H556_01/No.8

An object of weight *W* is suspended from two identical cables.

The tension in each cable is 2.0 N. Each cable makes an angle of 35° to the vertical.



What is the weight *W* of the object?

A 1.6 N

B 2.3 N

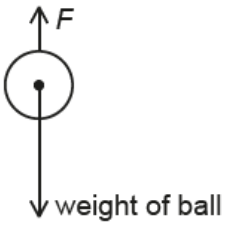
C 2.8 N

D 3.3 N

Your answer ☐ **[1]**

2. Nov/2021/Paper_H556_01/No.14

A ball of mass m is falling vertically through the air.



The total upward force acting on the ball is F. The force F is less than the weight of the object.
The acceleration of free fall is g.

Which expression is correct for the acceleration a of the ball?

A $a = 0$

B $a = \frac{mg - F}{m}$

C $a = \frac{mg + F}{m}$

D $a = g$

Your answer ☐ **[1]**

3. Nov/2021/Paper_H556_03/No.1(a)

Fig. 1 shows a high-speed electric train.

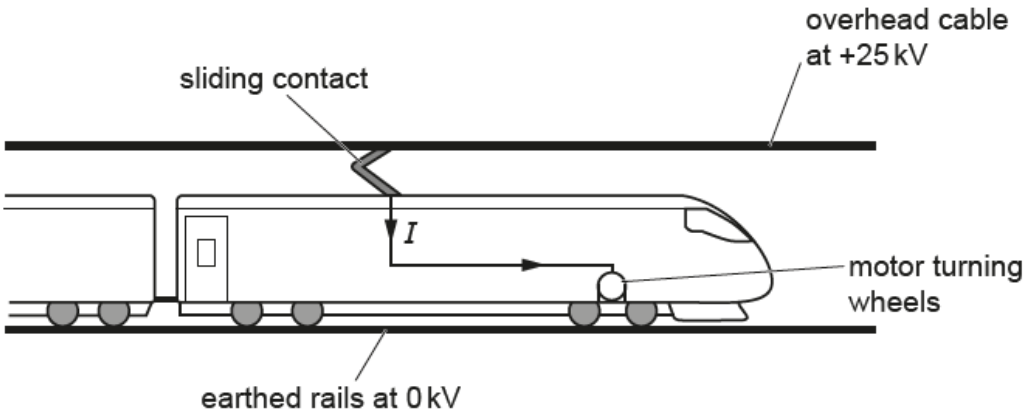


Fig. 1

The potential difference between the overhead cable and the rails on the ground is 25 kV.
The sliding contact on the top of the train constantly touches the overhead cable.
The overhead cable supplies a current I to the electric motor of the train.
The motor turns the wheels. The train experiences a **resultant** forward force F.

The total mass of the train is 2.1×10^5 kg.

(a) The train accelerates from rest. The value of F is 190 kN for speeds less than 6.0 m s^{-1}.

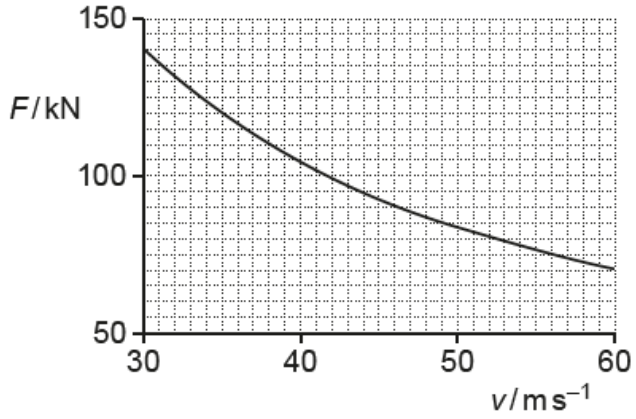
(i) Show that the train's acceleration is about 1 m s^{-2}.

[1]

(ii) Calculate the distance s that the train travels to reach a speed of 6.0 m s^{-1}.

s = ... m **[2]**

(iii) The speed of the train is v.
During one period of its journey, the train accelerates from $v = 30\,\text{m s}^{-1}$ to $v = 60\,\text{m s}^{-1}$.
The graph of F against v for this period is shown below.



1. Use the graph to show that output power of the electric motor during this period is constant at about 4 MW.

[3]

2. Calculate the current I in the electric motor when the train is travelling at $50\,\text{m s}^{-1}$.

I = ... A **[2]**