1.4 Linear Motion – Using $F = ma$

Exam Questions Checklist

Question	Comments	Attempted	Repeated
2014 Q1 (b)		□	□
2005 Q1 (b)		□	□
2004 Q1 (b)		□	□
1999 Q1 (a)		□	□
1994 Q1 (b)		□	□
1982 Q1 (b)		□	□
1970 Q1		□	□

2014 (b)

At a particular instant a car of mass 1200 kg is towing a trailer of mass 450 kg on a level road at a speed of 25 m s^{-1} when the engine exerts a constant power of 50 kW.
Friction and air resistance amount to 930 N on the car and 200 N on the trailer.

(i) Find the acceleration of the car at this instant.

(ii) Calculate the maximum speed at which the car (without the trailer) could travel up an incline of $\sin^{-1}\frac{1}{10}$ against the same resistance with the engine working at the same rate.

2005 (b)

A mass of 8 kg falls freely from rest. After 5 s the mass penetrates sand. The sand offers a constant resistance and brings the mass to rest in 0.01 s.

(i) Find the constant resistance of the sand

(ii) Find the distance the mass penetrates into the sand.

2004 (b)

A car of mass 1200 kg tows a caravan of mass 900 kg first along a horizontal road with acceleration f and then up an incline α to the horizontal road at uniform speed.
The force exerted by the engine is 2700 N. Friction and air resistance amount to 150 N on the car and 240 N on the caravan.

(i) Calculate the acceleration, f, of the car along the horizontal road.

(ii) Calculate the value of α, to the nearest degree.

1999 (a)

A car of mass 1500 kg travels up a slope of gradient $\sin^{-1}\left(\frac{1}{50}\right)$ against a constant resistance of 0.2 N per kilogram.
Find

(i) the constant force required to produce an acceleration of 0.1 m/s^2.

(ii) the power which is developed when the speed is 20 m/s.

1994 (b)

In a lift, moving upwards with acceleration f, a spring balance indicates an object to have a weight of 98 N. When the lift is moving downwards with acceleration $2f$ the weight appears to be 68.6 N.
Calculate

(i) the actual weight .

(ii) the downward acceleration of the lift.

1982 (b)

A particle of mass 3 grammes falls from rest from a height of 0.4 m on to a soft material into which it sinks 0.0245 m.
Neglecting air resistance, calculate the constant resistance of the material.

1970

A bullet of mass m is fired with speed v into a fixed block of wood and is brought to rest in a distance d. Find the resistance to motion assuming it to be constant.
Another bullet also of mass m is then fired with speed $2v$ into another fixed block of thickness $2d$, which offers the same resistance as the first block. Find the speed with which the bullet emerges, and the time it takes to pass through the block.