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(*a*) State Newton's second law of motion. (6)

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A downhill skier of mass 71 kg started from rest and travelled a distance of 400 m on a downhill ski course. Her loss of elevation was 90 m.

What is the principal energy conversion that is taking place as the skier travels along the course? (4)

Ignoring friction, calculate her maximum velocity when she has travelled 400 m. (9)

She then ploughed into a snow drift and came to a stop in a time of 0.8 seconds.

What is the force that she exerts on the snow drift?

What force does the snow drift exert on her? (9)

(acceleration due to gravity = 9.8 m s^{-2})

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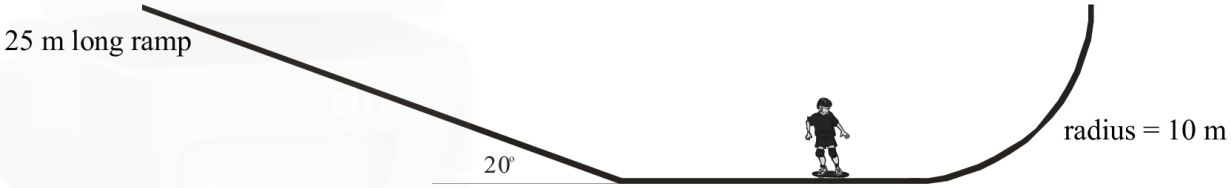
6. State Newton's laws of motion. (12)

Show that $F = ma$ is a special case of Newton's second law. (10)

A skateboarder with a total mass of 70 kg starts from rest at the top of a ramp and accelerates down it. The ramp is 25 m long and is at an angle of 20° to the horizontal. The skateboarder has a velocity of 12.2 m s^{-1} at the bottom of the ramp.



Calculate

(i) the average acceleration of the skateboarder on the ramp.
(ii) the component of the skateboarder's weight that is parallel to the ramp.
(iii) the force of friction acting on the skateboarder on the ramp. (18)

The skateboarder then maintains a speed of 10.5 m s^{-1} until he enters a circular ramp of radius 10 m.

What is the initial centripetal force acting on him?

What is the maximum height that the skateboarder can reach? (12)

Sketch a velocity-time graph to illustrate his motion. (4)

(acceleration due to gravity = 9.8 m s^{-2})

(a) What is friction? (6)

A car of mass 750 kg is travelling east on a level road. Its engine exerts a constant force of 2.0 kN causing the car to accelerate at 1.2 m s^{-2} until it reaches a speed of 25 m s^{-1}.

Calculate (i) the net force, (ii) the force of friction, acting on the car. (12)

If the engine is then turned off, calculate how far the car will travel before coming to rest. (10)