Multiple Choice Questions 1 → 10
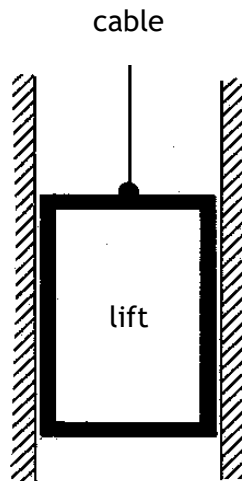
1. A block of wood, of mass 2·0 kg, slides with a constant velocity down a slope. The slope makes an angle of 30˚ with the horizontal as shown in the diagram.
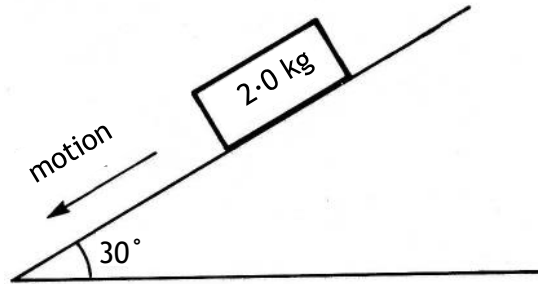
   Calculate the magnitude of the force of friction acting on the block.

    A   1·0 N

    B   1·7 N

    C   9·8 N

    D   17·0 N

    E   19·6 N

2. A lift is raised and lowered by the use of a cable.

   Identify in which of the following situations the tension in the cable is the greatest.

    A   the lift is travelling upwards at a constant speed.

    B   the lift is travelling downwards at a constant speed.

    C   the lift is decelerating on the way down.

    D   the lift is accelerating on the way down.

    E   the lift is decelerating on the way up.

3. A car of mass 900 kg pulls a caravan of mass 400 kg along a straight, horizontal road with an acceleration of 2 ms^{-2}.

coupling

900 kg

400 kg
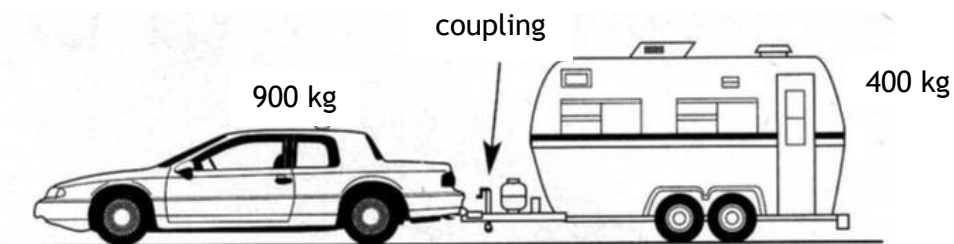
Calculate the tension in the coupling.

A   400 N

B   800 N

C   900 N

D   1800 N

E   2600 N

4. A cyclist free-wheels down a slope, inclined at 15° to the horizontal, at a constant velocity of 3 ms^{-1}.

15°
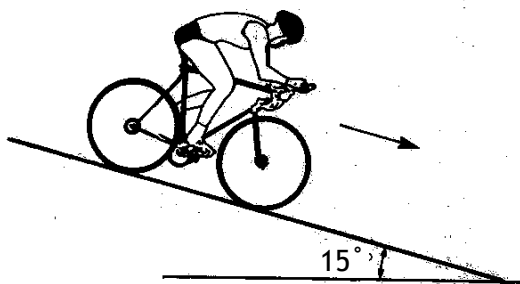
The combined mass of the rider and bicycle is 70 kg.
Calculate the magnitude of the force of friction acting on the bicycle and rider.

A   2.5 N

B   18·1 N

C   67·6 N

D   177·6 N

E   662·6 N

5. A sledge is dragged at a constant velocity along the snow against a horizontal frictional force F. The rope pulling the sledge is at an angle of θ to the horizontal, as shown.

force P

sledge

θ

friction force F
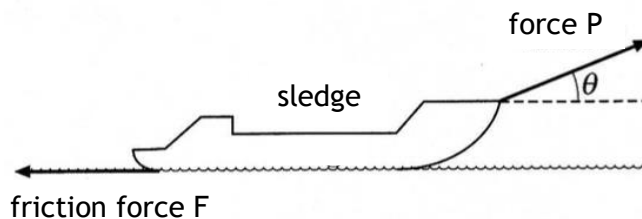
The sledge is moving horizontally with a constant velocity. Identify how the pulling force P pulling the rope is found.

A   F

B   F cos θ

C   F sin θ

D $\dfrac{F}{cos\theta}$

E $\dfrac{F}{sin\theta}$

6. An object of mass 1·0 kg hangs from a spring balance which is suspended on the inside of a small rocket, as shown below.
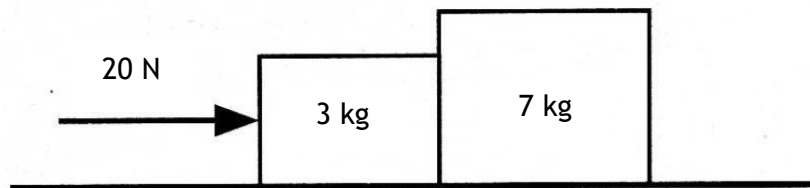
spring
balance

rocket

1·0 kg
mass
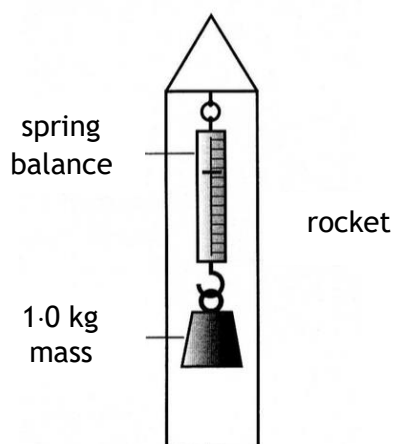
The rocket accelerates upwards at 2·0 ms^{-2}.

Calculate the reading on the balance.

A   0.0 N

B   2·0 N

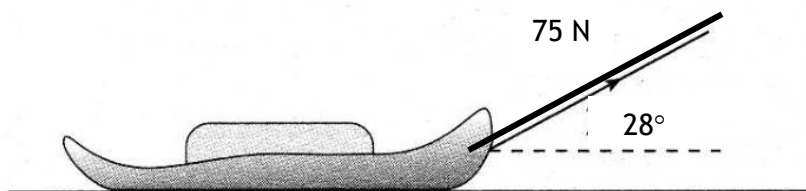C   7·8 N

D   9·8 N

E   11·8 N

7. A horizontal force of 20 N is applied as shown to two wooden blocks of masses 3 kg and 7 kg. The blocks are in contact with each other on a frictionless horizontal surface.

Calculate the magnitude of the horizontal force acting on the 7 kg block.

A   20 N

B   14 N

C   10 N

D   8 N

E   6 N

8. A sledge is pulled a distance of 8 m in a straight line along a horizontal surface.

The tension in the rope is 75 N and the angle between the rope and the horizontal surface is 28°. Identify which row in the following table is correct.

|	horizontal component of tension (N)	vertical component of tension (N)	work done by the rope (J)
A	75 sin 28°	75 sin 62°	600
B	75 cos 28°	75 sin 28°	530
C	75 sin 62°	75 sin 28°	600
D	75 cos 28°	75 sin 62°	600
E	75 sin 28°	75 cos 28°	35

9. A car of mass 1000 kg is travelling at a speed of 40 ms^{-1} along a straight road. The brakes are applied and the car decelerates to 10 ms^{-1}.
    Calculate how much kinetic energy is lost by the car.

    A   15 kJ

    B   50 kJ

    C   450 kJ

    D   750 kJ

    E   800 kJ

10. The total mass of a motorcycle and rider is 250 kg. During braking, they are brought to rest from a speed of 16·0 ms^{-1} in a time of 10·0 s.
    Calculate the maximum energy which could be converted to heat in the brakes.

    A   2 kJ

    B   4 kJ

    C   32 kJ

    D   40 kJ

    E   64 kJ

11. A box of mass 18 kg is at rest on a horizontal frictionless surface. A force of 4·0 N is applied to the box at an angle of 26˚ to the horizontal.
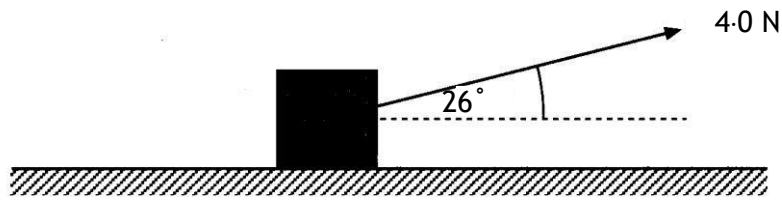

(a) (i) Show that the horizontal component of the force is 3·6 N.

(ii) Calculate the acceleration of the box along the horizontal surface.

(iii) Calculate the horizontal distance travelled by the box in a time of 7·0 s.

(b) The box is replaced at rest at its starting position. The force of 4·0 N is now applied to the box at an angle of less than 26˚ to the horizontal.
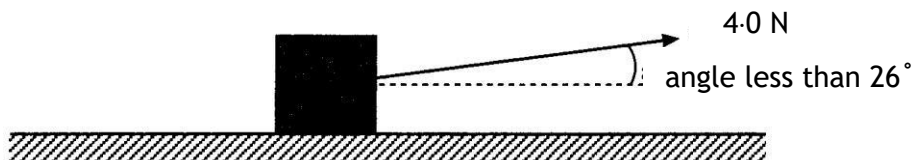

The force is applied for a time of 7·0 s as before.
State how the distance travelled by the box compares with your answer to part (a)(iii).
You must justify your answer.

12. A van of mass 2600 kg moves down a slope which is inclined at 12° to the horizontal as shown.

not shown to scale

A

B

75 m

12°
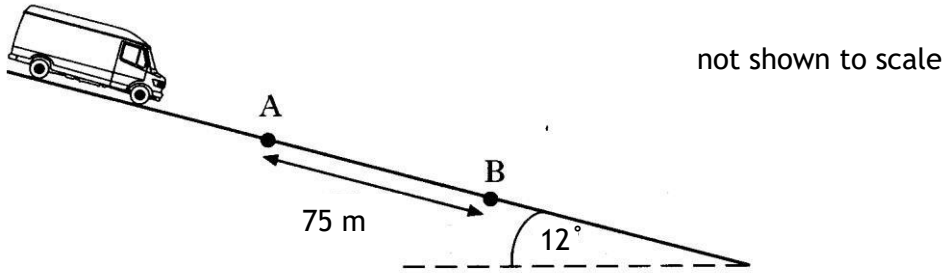
(a) Calculate the component of the van's weight acting parallel to the slope.

(b) A constant frictional force of 1400 N acts on the van as it moves down the slope. Calculate the acceleration of the van.

(c) The speed of the van as it passes **point A** is 5·0 ms⁻¹. Point B is 75 m further down the slope. Calculate the kinetic energy of the van at **point B**.

13. A crate of mass 40·0 kg is pulled up a slope using a rope. The slope is at an angle of 30° to the horizontal.

240 N

30°
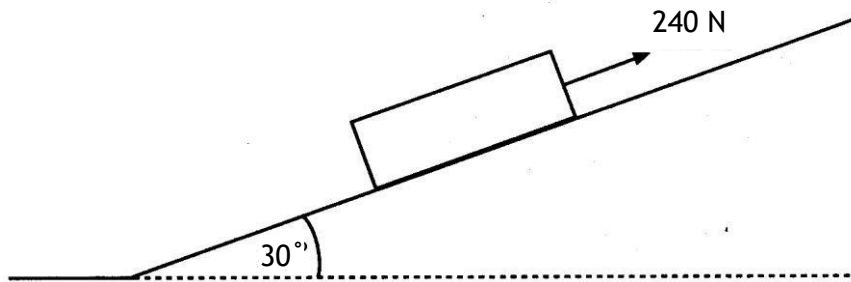
A force of 240 N is applied to the crate parallel to the slope. The crate moves at a constant speed of 3·0 ms⁻¹.

(a) Calculate the component of the weight acting parallel to the slope.

(b) Calculate the magnitude of the frictional force acting on the crate.

14. A fairground ride consists of rafts which slide down a slope into water.
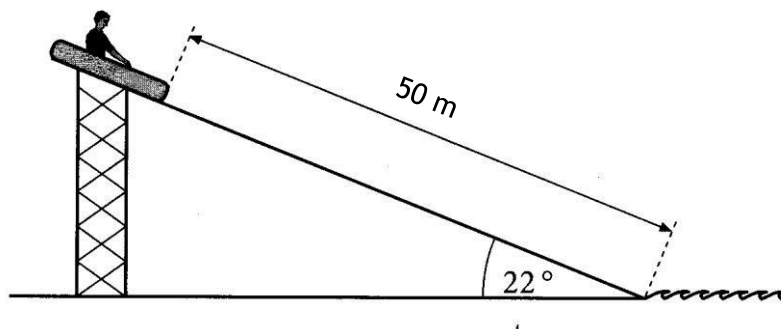
The slope is at an angle of 22° to the horizontal. Each raft has a mass of 8·0 kg. The length of the slope is 50 m.

A child of mass 52 kg sits in a raft at the top of the slope. The raft is released from rest. The child and raft slide together down the slope into the water. The force of friction between the raft and the slope remains constant at 180 N.

(a) Calculate the component of weight of the child and raft acting down (parallel) the slope.

(b) Show that the acceleration of the child and raft down the slope is 0·67 ms^{-2}.

(c) Calculate the speed of the child and raft at the bottom of the slope.

(d) A second child of smaller mass is released from rest in an identical raft at the same starting point. The force of friction is the same as before.
State how does the speed of the child and raft at the bottom of the slope compare with the answer to part (c).
Justify your answer.