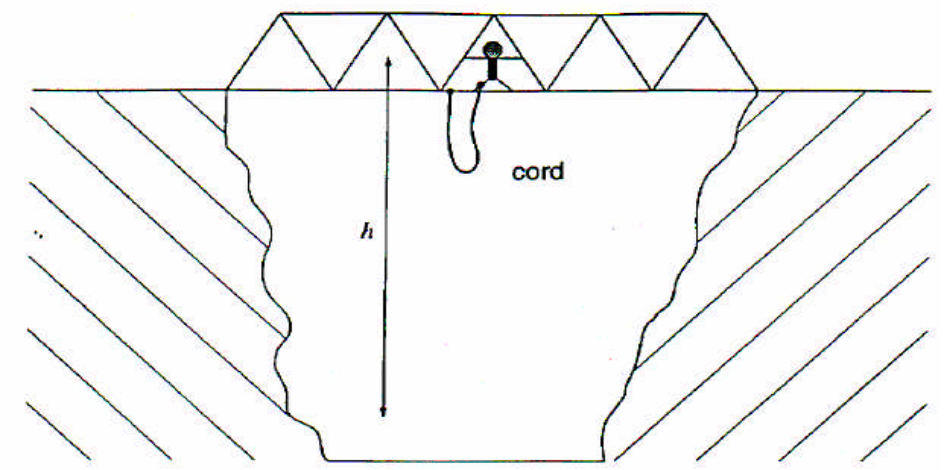
Chapter 9
Multiple choice and Quick Questions

1. The diagram shows a person about to take part in the hazardous activity of bungee jumping.
An elastic cord is tied to the person, its length being such that he is brought to a temporary halt just above ground level having fallen through the distance *h*.



Which of the following is/are required to calculate the maximum distance, *h*, fallen?

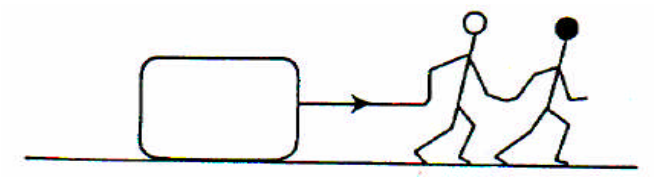
1 the mass of the participant

2 the natural, unstretched, length of the cord

3 the spring constant of the cord (assumed to obey the Hooke Law)

A 1, 2 and 3 ✓ **B** 1 and 2 **C** 2 and 3 **D** 1 only

2. Two children are dragging a cardboard box at a steady speed along a flat level floor. They are pulling it to the right by a rope parallel to the floor.



Which of the following statements about the forces involved is/are correct?

1 the tension in the rope is equal in magnitude to the frictional force between the floor and the box

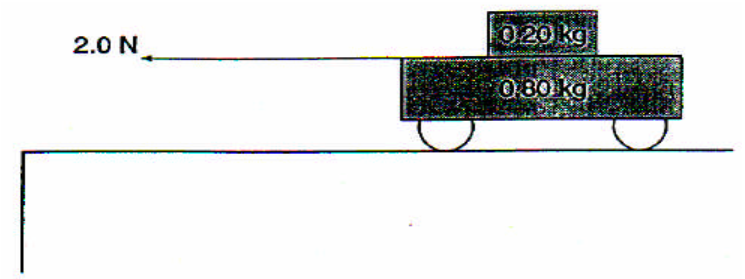
2 the frictional force on the box acts to the left

3 there is a frictional force between the children and the floor

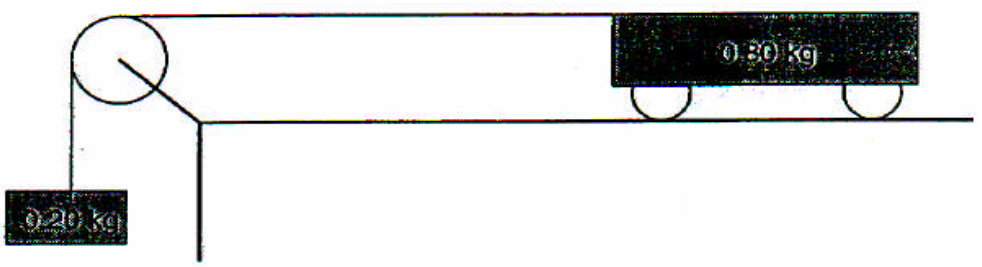
A 1 only **B** 2 only **C** 1 and 3 only

D 2 and 3 only **E** 1, 2 and 3 ✓

3. A cord is attached to a laboratory dynamics trolley of mass 0.80kg. When the trolley is in motion there is a constant frictional force of 0.50 N.



A mass of 0.20 kg is secured to the trolley and a force of 2.0 N is applied with the cord as shown above.
Which one of **A** to **D** below is the acceleration, in m s^{-2}, of the trolley?



A 1.5 ✓ **B** 1.9 **C** 2.5 **D** 3.1

4. The cord is now hung over a pulley and the 0.20 kg mass attached as shown in the diagram above. The frictional force remains 0.50 N.

Which one of **A** to **D** below is now the acceleration, in m s^{-2}, of the trolley?
g = 10 N kg^{-1}

A 1.5 ✓ **B** 1.9 **C** 2.5 **D** 3.1

5. Which one of **A** to **E** below is equal to the rate of change of momentum of an accelerating car?

A the resultant force acting on the car ✓

B the impulse acting on the car

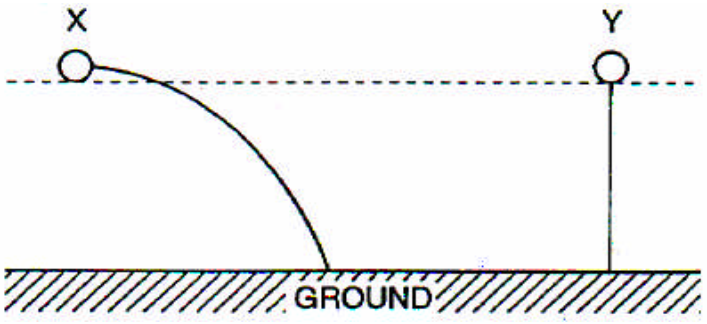
C the rate of change of kinetic energy of the car

D the power required to accelerate the car

E the acceleration of the car

6. Ball X is projected horizontally at the same instant and from the same height as another ball Y is released. The ball Y is allowed to fall vertically.

The diagram below shows the path of each ball.



Assuming the effects due to air resistance are negligible, which of the following statements about this situation is/are true?

1 The time taken for X to reach the ground is the same as that for Y.

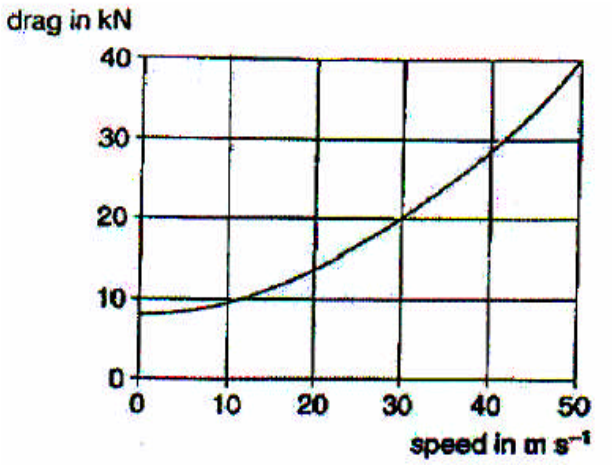
2 The speed at which X strikes the ground is the same as that of Y.

3 The force on X during the fall varies in size and direction whilst that on Y is constant.

A 1 only ✓ **B** 2 only **C** 1 and 3 only

D 2 and 3 only **E** 1, 2 and 3

7. The graph shows how the drag force on a high speed train varies with its speed through still air. The drag is the sum of the air resistance, which varies with speed, and friction, which is constant.



Which one of **A** to **E** below is the value, in kN, of the drag due to friction alone?

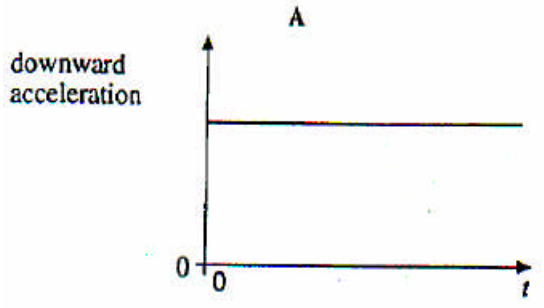
A 0 **B** 8 ✓ **C** 32 **D** 40 **E** 50

8 Which one of **A** to **E** below is the power, in kW, required to maintain a steady speed of 50 m s^{-1}?

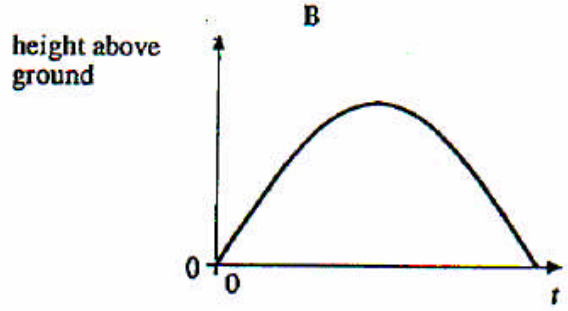
A 40 **B** 400 **C** 1000 **D** 2000 ✓ **E** 2 x 10^6

9. A ball is thrown vertically upwards at time $t = 0$. It reached its maximum height and then falls freely towards the ground where it is caught at time t.

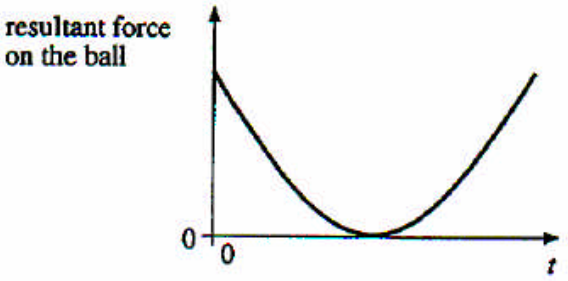
Which one of the graphs below is **incorrect**? (Ignore any effects of air resistance.)



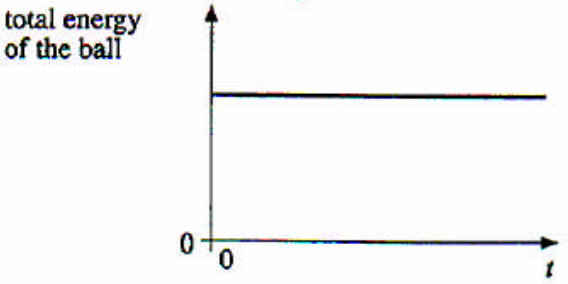
B


height above ground
0
0
t

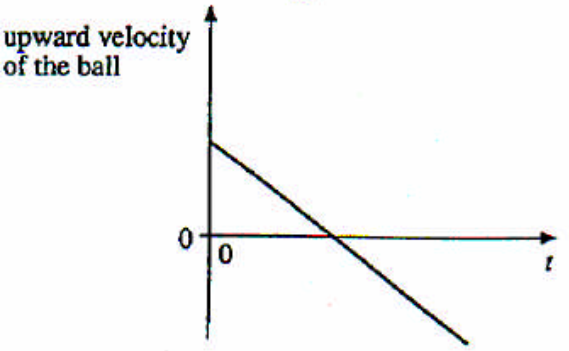
C


resultant force on the ball
0
0
t

D


total energy of the ball
0
0
t

E


upward velocity of the ball
0
0
t

A B C ✓ D E

10. This question is about the physics of pole vaulting.

Fig. 8 shows the sequence of actions when pole vaulting. The athlete achieves a great height by using the pole to convert two forms of energy into gravitational potential energy.

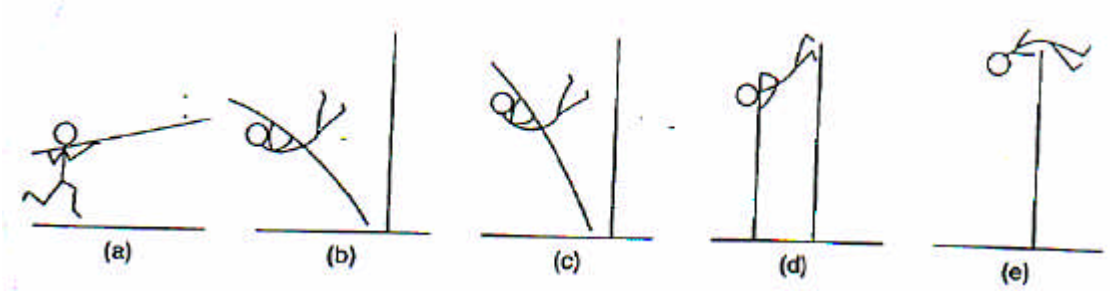


Fig. 8

(a) One form is his kinetic energy. What is the other?

The elastic strain energy stored in the pole when the athlete pulls down on the pole and bends it.

(b) Estimate the mass, *m* and maximum speed, *v* of the athlete.

$m =$ 50 – 100 kg

$v =$ 5 – 12 ms^{-1}

(c) Use your answer to part (b) to estimate the height the athlete might clear by virtue of the conversion of just her kinetic energy.

$$\text{KE (max)} = \frac{1}{2}mv^2 \cong 4{,}000\ \text{J}$$

$$\Delta KE = \Delta PE$$

$$4000 = mg\hbar$$

$$\hbar = \frac{4000}{1000} \cong 4\text{m}$$