Name:	Target Grade:	Actual Grade:

BRIGHT CULTURE

FORCES AND ENERGY
MCQ and STRUCTURED QUESTIONS

READ THESE INSTRUCTIONS FIRST

INSTRUCTIONS TO CANDIDATES

1. Find a quiet, comfortable spot free place from distractions.
2. Spend one minute on each mark.
3. Time yourself for every single question.
4. Every chapter has their own question types. Ensure that you know the different question type for each chapter.
5. Make a conscientious effort to remember your mistakes, especially in terms of answering techniques. E.g Take a picture for the mistakes that you made, keep it in a photo album, and revise it over and over again.
6. Highlight question types that you tend to keep making mistakes and review them nearing exams.
7. Always review the common questions and question type that you tend to make mistakes nearing exams.
8. During exams, classify the question type and recall what you have learnt, how you need to analvse the questions for the different question type, what you need to take note of and answer with the correct answering techniques!

✨ Wishing you all the best for this test!

You've got this!

💡 With lots of love,
Bright Culture 💛

MARKS

If you are struggling in this paper, means you need to work harder!

If you need any professional guidance and further advice on how to advance, feel free to WhatsApp us at 91870820 or find us at www.bright-culture.com/. We are committed to connect you to your future to reach your goals.

FORCES AND ENERGY MCQ

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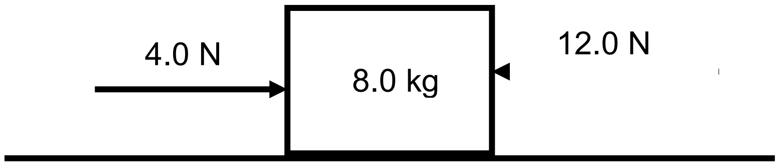
Which statement is correct?



A The object will immediately move to the left.
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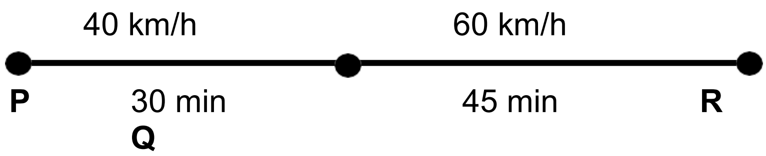
D The object will come to an immediate stop and move to the left with a constant speed.

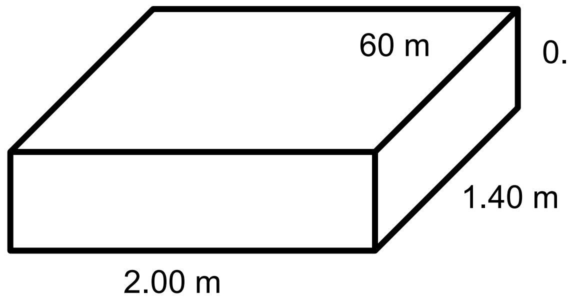
2 A car travels from point **P** to point **R**. The car travels from **P** to **Q** at 40 km/h for 30 min, stops for 30 min, and then continues from **Q** to **R** at 60 km/h for 45 min.

What is the average speed of the car for the entire journey?



A 37 km/h
B 45 km/h
C 50 km/h
D 81 km/h

3 A block of mass 150 kg has the dimensions as shown.



What would the largest possible pressure exerted by the block on the ground be?

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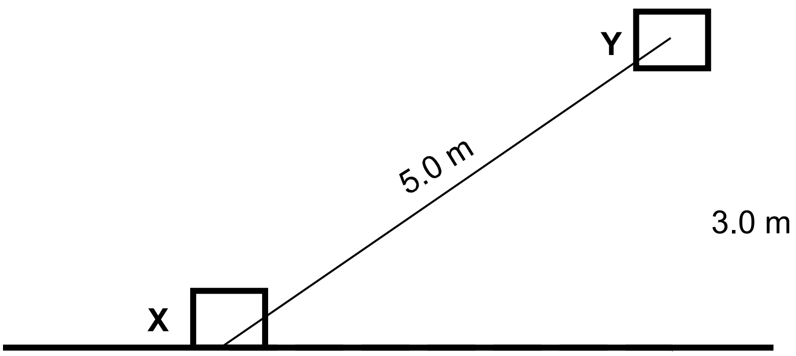

What is the work done against gravity?
(Take the gravitational field strength, g, to be 10 N / kg.)

A 15 J
B 25 J
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D 250 J

5 A 3.0 kg object is released from rest from a height of 15 m. If it reaches the ground with a speed of 15.0 m/s, what would the energy lost to the surroundings be?
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A 23 J
B 110 J
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6 A girl of weight 450 N runs up a flight of 15 steps. If each step is 25 cm in height, what is the power developed if she took 7.0 seconds to run up the flight of steps at constant speed?

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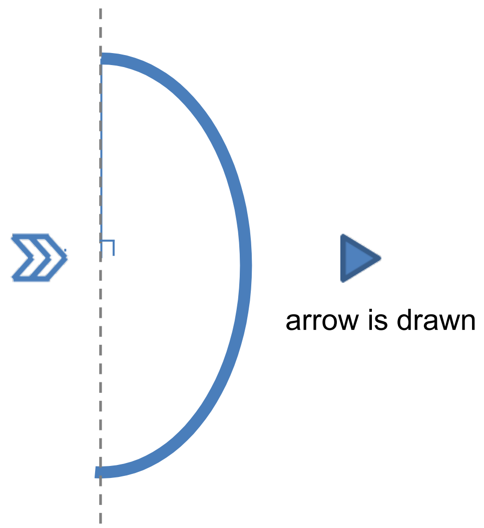

What will be the main energy conversion at the point of release?

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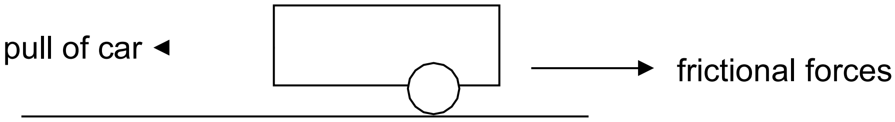

Which values of the forces will cause the trailer to move with a constant speed?

	pull of car / N	frictional forces / N
A	50	100
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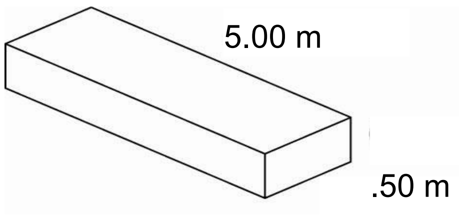
What is the pressure exerted by the sea water on the base of the tank?



A 1400 Pa
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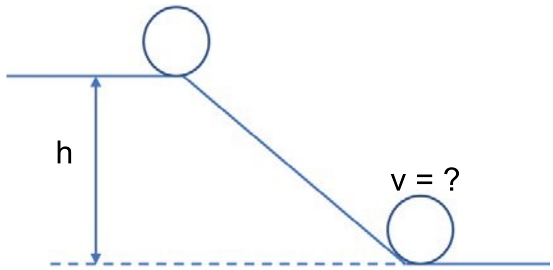
10 An object of mass *m* rolls down from rest from the top of a frictionless slope of height *h*. When it reaches the bottom, its speed is *v*.

What would be the speed at the bottom for an object of mass *2m*, if it is rolled off from the top of the same slope?



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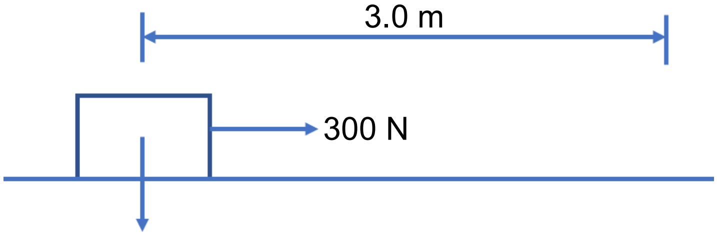

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What the average speed for the round trip?

A 2.4 m s^{-1}
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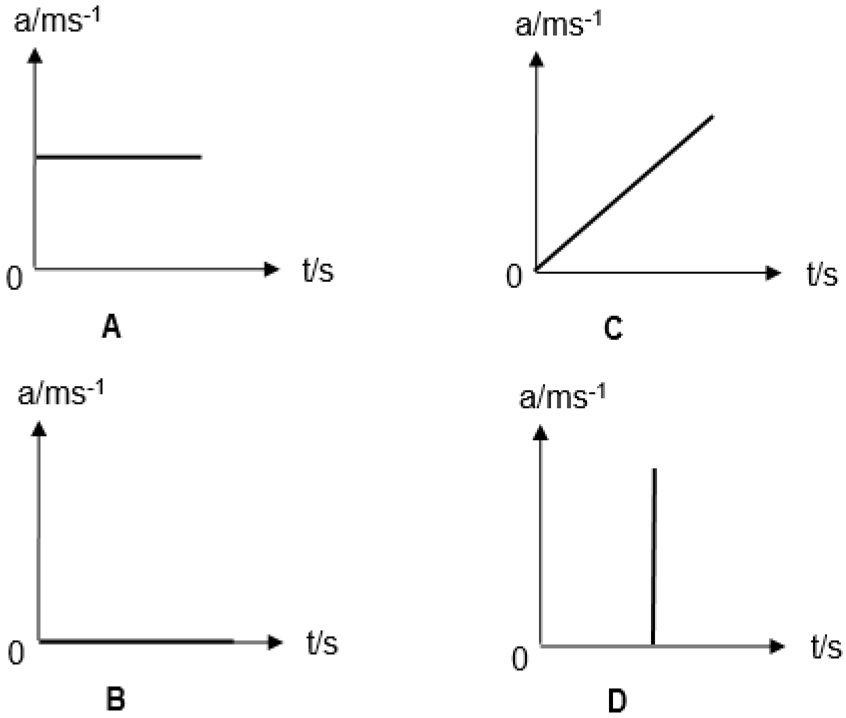

FORCES AND ENERTGY STRUCTURED QUESTIONS

1 (a) Describe what happens to the toy car when it is being released.

....
[1]

(b) Draw a **labelled** free body diagram of the toy car at the bottom of the ramp.

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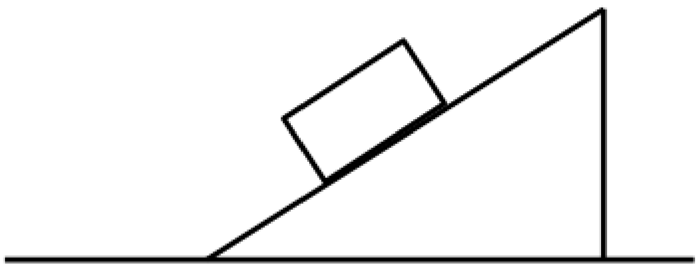

Fig. 7.1

(a) On Fig 7.1, draw all forces acting on the box. Label the forces clearly.
[2]

(b) Calculate the weight of the box on Earth. The gravitational field strength on Earth is 10 N/kg.

weight = ________________
[1]

(c) Explain how the mass of the box might change if it was brought to a planet with a gravitational field strength 4.7 N/kg.

[1]

(d) State the *Principle of Conservation of Energy*.

[2]

(e) Fig 7.2 shows the same box which was then brought to the top of another slope.

(i) Calculate the gravitational potential energy at the top of the slope.

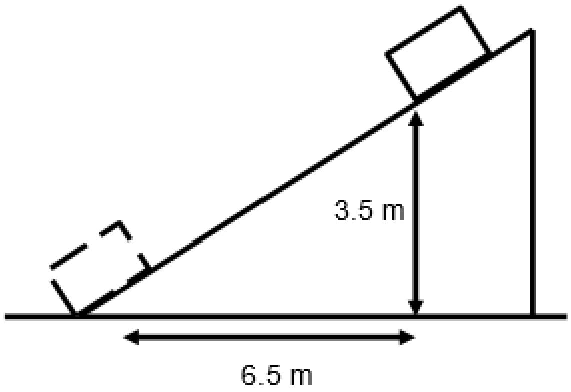

Fig. 7.2

gravitational potential energy = ____________________

[1]

(ii) The box is then released and it begins to slide down. Assuming the energy loss due to friction of the slope is 2.5 J, determine the speed of the box just as it reaches the ground.

speed = ____________________

[2]

Total [9]

3 Hydraulic presses are used in day to day applications to lift heavy loads with small amounts of effort. In a car workshop (Fig 8.1), a mechanic needs to raise a car of weight 15 000 N upwards using a hydraulic press. A simplified diagram of the hydraulic press is shown in Fig 8.2.

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Piston **X** has an area of 0.50 m^2 and Piston **Y** has an area of 2.0 m^2.

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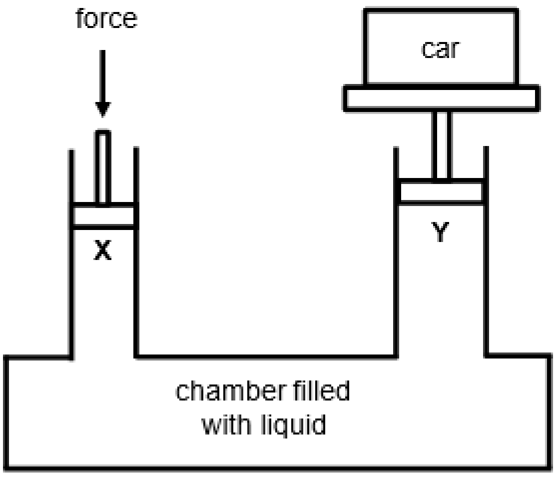

Fig. 8.2

a. Calculate the pressure exerted on piston **Y**.

pressure = ______________________

[2]

b. Hence, based on Pascal's Principle, calculate the force required on piston **X**.

force = ____________________
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c. Assuming energy losses due to friction is negligible, the work done by both pistons are the same.

Hence, calculate the distance piston **X** has to move, in order to lift the car up a height of 2.0 m.

distance moved by piston **X** = ____________________
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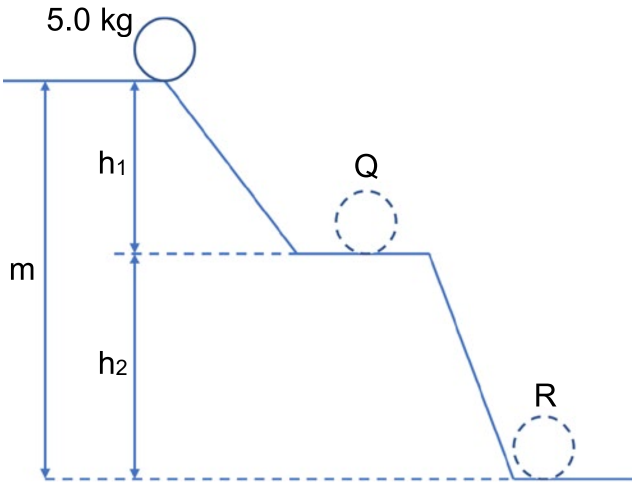

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(a) **(i)** Determine the speed of the ball when it just reaches the bottom, at position R.

speed = ____________________

[2]

(ii) At position Q, the ball has a speed of 5.0 m/s.
Hence or otherwise, determine the heights h_1 and h_2.

h_1 = ____________________

h_2 = ____________________

[2]

(b) Explain why, when this experiment was carried out, the speed measured at the bottom of the slope is different from the calculation in **(a)(i)**.

[1]

Total [5]

5 Fig. 7.1 shows the speed-time graph of an electric scooter as it moves from rest to a destination some distance away.

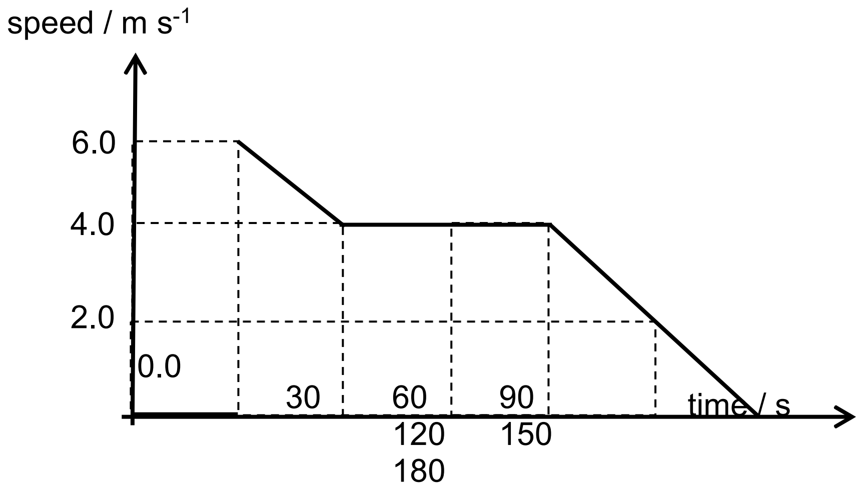

Fig. 7.1

Using the graph, determine the

(a) maximum speed attained by the electric scooter.

maximum speed =

[1]

(b) acceleration of the electric scooter in the first 30 s of the journey.

acceleration =

[2]

(c) distance travelled when the electric scooter was travelling at constant speed.

distance = [1]

[Total: 6m]

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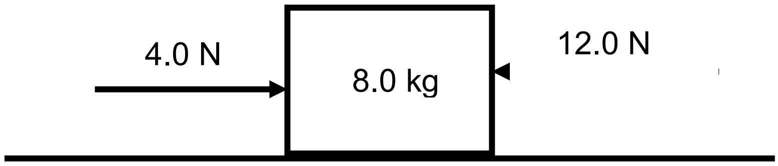

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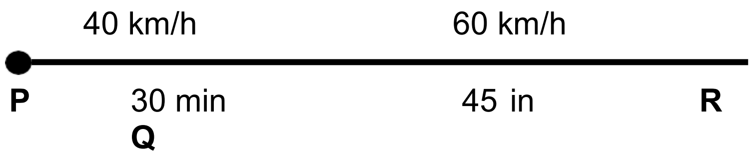

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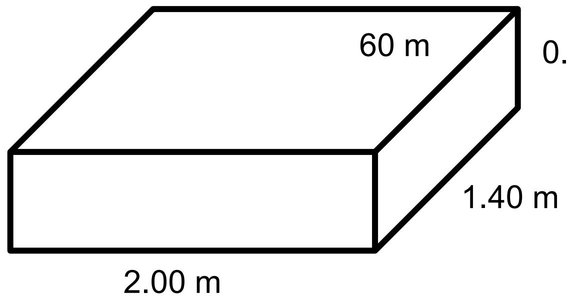

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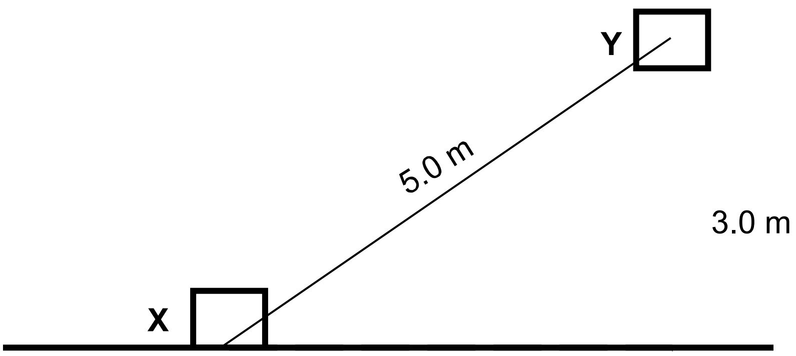

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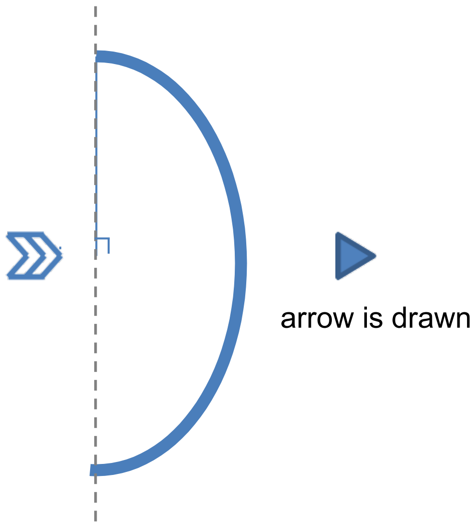

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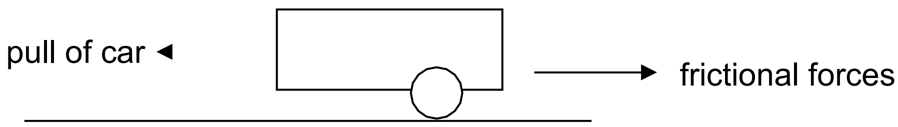

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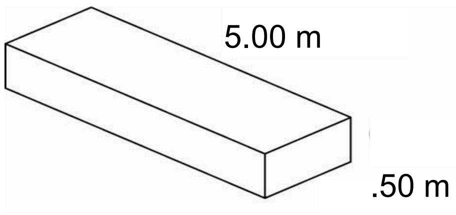

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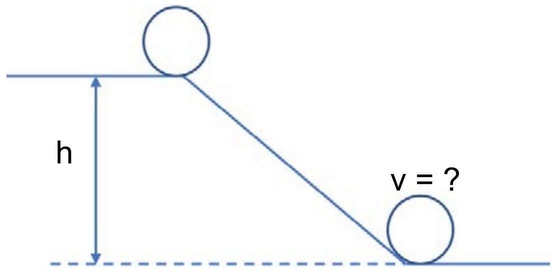

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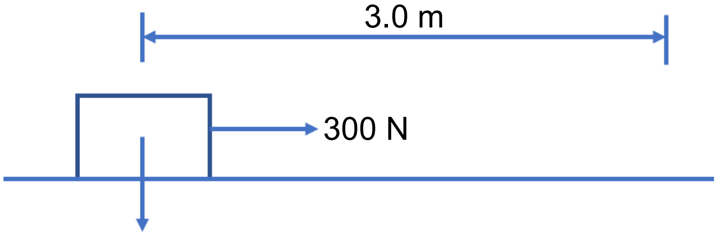

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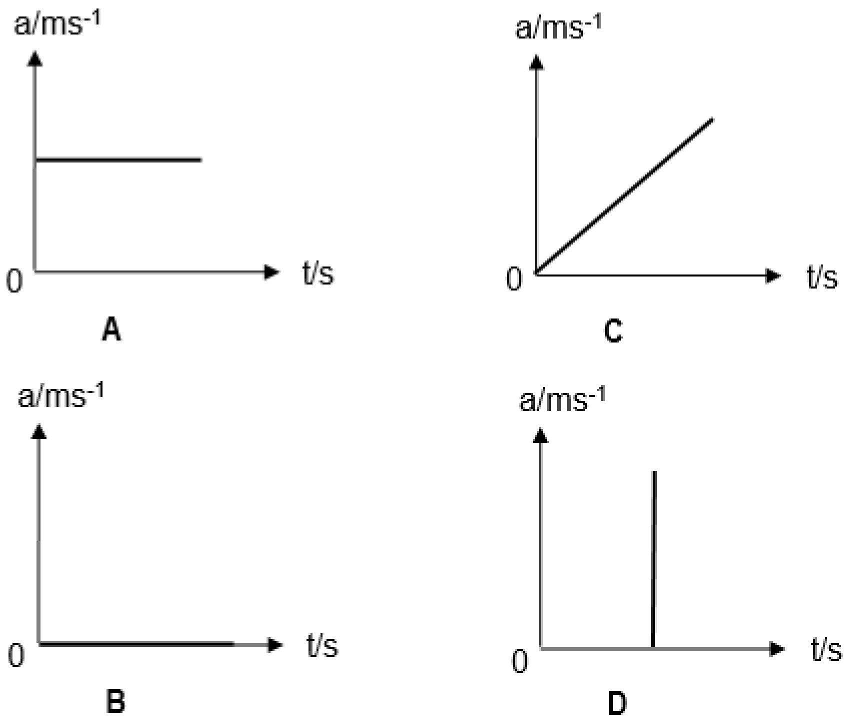

Ans: B

ANSWERS FOR FORCES AND ENERGY STRUCTURED QUESTIONS

1 **(a)** Describe what happens to the toy car when it is being released.

The toy car accelerates down the ramp. [B1]
Do not accept moves down the ramp.

.... [1]

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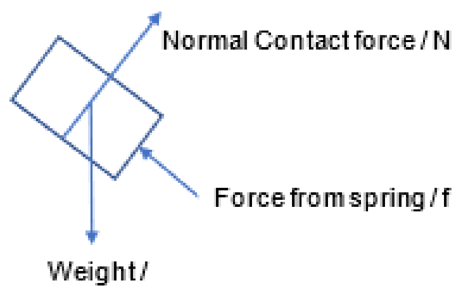

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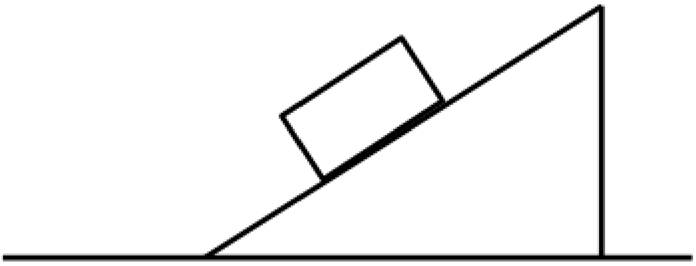

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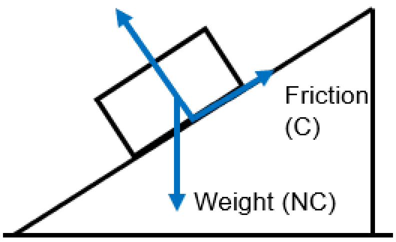

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(b) Calculate the weight of the box on Earth. The gravitational field strength on Earth is 10 N/kg.

W = mg
= (0.500 kg) (10 N/kg)
= 5.00 N (3 s.f.)

[1]

(c) Explain how the mass of the box might change if it was brought to a planet with a gravitational field strength 4.7 N/kg.

(b) The mass will remain unchanged. Only the weight changes.OR Mass is not affected by gravitational field strength.

[1]

(d) State the *Principle of Conservation of Energy*.

Energy cannot be created or destroyed.
It can only be converted from one form to another.

[2]

Fig 7.2 shows the same box which was then brought to the top of another slope.

i. Calculate the gravitational potential energy at the top of the slope.

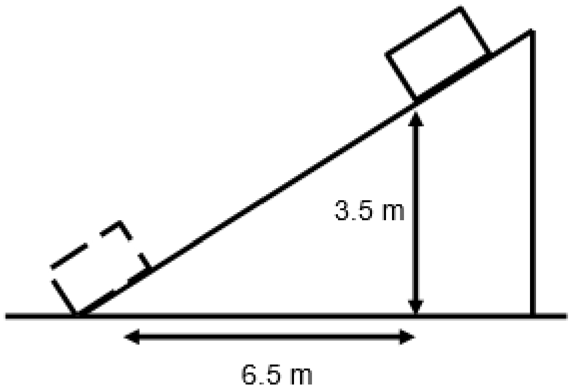

Fig. 7.2

gravitational potential energy = GPE = mgh
= (0.500 kg)(10 N/kg)(3.5 m)
= 17.5 J
= 18 J (2.s.f)
×ecf if weight was calculated wrongly in (b)

[1]

ii. The box is then released and it begins to slide down. Assuming the energy loss due to friction of the slope is 2.5 J, determine the speed of the box just as it reaches the ground.

Energy at top = energy at bottom + energy loss
17.5 J = E at bottom + 2.5 J
(value used should be 'raw' value, i.e. 17.5 J)

E = 15 J = ½ mv^2
v^2 = (15) / (1/2 × 0.500) v = 7.74596
v = 7.7 m/s (2.s.f) or 7.75 m/s (3.s.f)

If E = 15.5, accepted answers would be: 7.9 m/s (2 s.f) or 7.87 m/s (3 s.f.)

Total [9]

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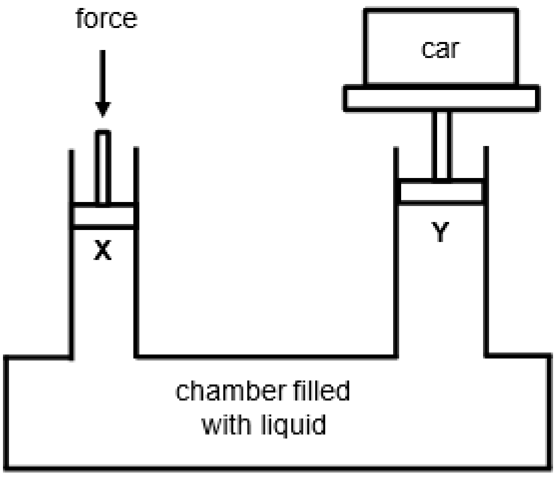

Fig. 8.2

a. Calculate the pressure exerted on piston **Y**.

$P_Y = F/A$
$= (15\,000 \text{ N} / 2.0 \text{ m}^2)$ [1]
$= 7500 \text{ N/ m}^2$ [1]

[2]

b. Hence, based on Pascal's Principle, calculate the force required on piston **X**.

P at Y = P at X
7500 = F / (0.50) [1]
F = 3750 (3 s.f) N or 3800 (2 s.f) [1]

[2]

c. Assuming energy losses due to friction is negligible, the work done by both pistons are the same.

Hence, calculate the distance piston **X** has to move, in order to lift the car up a height of 2.0 m.

distance moved by piston **X**

WD by car = WD by piston X 15000 ×2.0 = 3750 × d [1]
d = 8.0 m [1]
(7.9 m) if 3800 N was used instead

[2]

Total [6]

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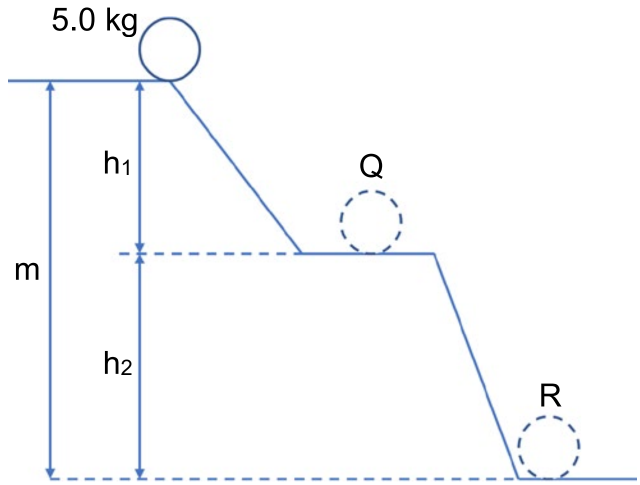


Fig. 9.1

a. **(i)** Determine the speed of the ball when it just reaches the bottom, at position R.

GPE_{top}= mgh = (5.0 kg)(10 N/kg)(12.0 m) = 600 J OR ½ mv^2 = 600 J

Hence, KE_{bottom} = 600 J mgh = ½ mv^2

v = √(2gh) = √(2 x 10 x 12.0) = 15.49 = 15.5 m/s (3s.f.)
OR = 15 m/s) (2s.f.)

____

[2]

(ii) At position Q, the ball has a speed of 5.0 m/s.
Hence or otherwise, determine the heights h_1 and h_2.

KE_Q = ½ mv^2 = (1/2) (5.0 kg)$(5.0 m/s)^2$ = 62.5 J

GPE_Q = GPE_{top} – KE_Q = 600 – 62.5 = 537.5 J

Hence, h_2 = 10.75 m

h_1 = 12 – h_2 = 12 – 10.75 = 1.25 m
OR = 1.3 m (2s.f.)

Alternate method (find h_1 first): KE_Q = mgh_1
½ (5.0 kg) $(5.0m/s)^2$ = (5.0kg)(10N/kg)(h_1) h_1 = 1.25 m

h_2 = 12 – 1.25 = 10.75 m

b. Explain why, when this experiment was carried out, the speed measured at the bottom of the slope is different from the calculation in **(a)(i)**.

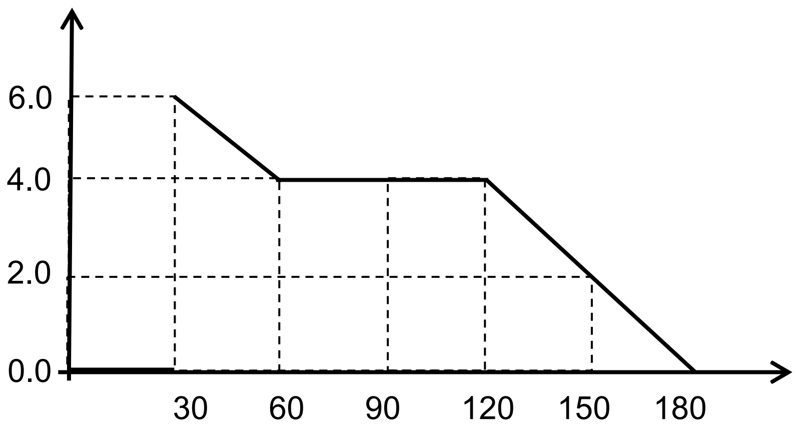
Energy is lost to the surroundings as work done is done against friction.

[1]

Total [5]

5 Fig. 7.1 shows the speed-time graph of an electric scooter as it moves from rest to a destination some distance away.

speed / m s^{-1}



time/s

Fig 7.1

Using the graph, determine the

(d) maximum speed attained by the electric scooter.

maximum speed = 6 ms^{-1} [1]

(e) acceleration of the electric scooter in the first 30 s of the journey.

$a = \frac{v-u}{t} = \frac{6-0}{30}$

$= 0.20\ ms^{-2}$

[2]

(f) distance travelled when the electric scooter was travelling at constant speed.

Distance = 4 x (120 – 60) = 240 m [1]

[Total: 6m]