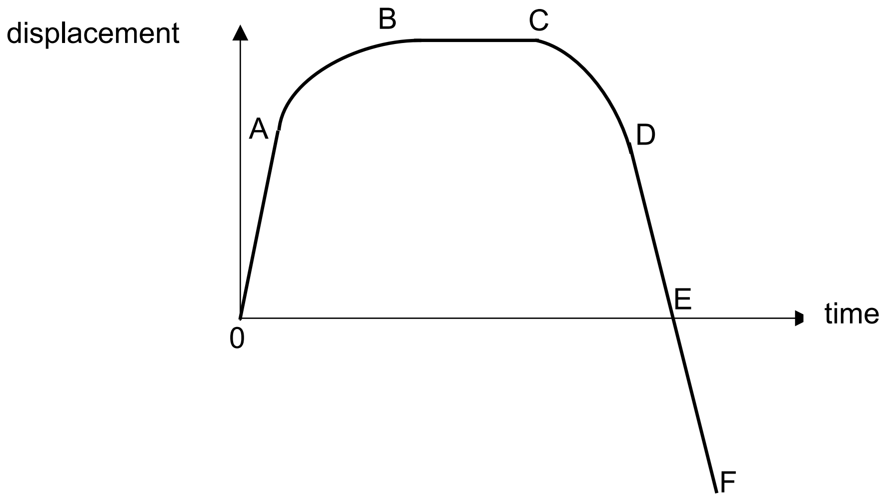
2026 EOY Revision
Mechanics Topical

Name: ____________________ ( ) **Class: 3/** _____ **Date:** _________

Kinematics

1 A car moves along a straight road. The **displacement**-time graph is shown below.

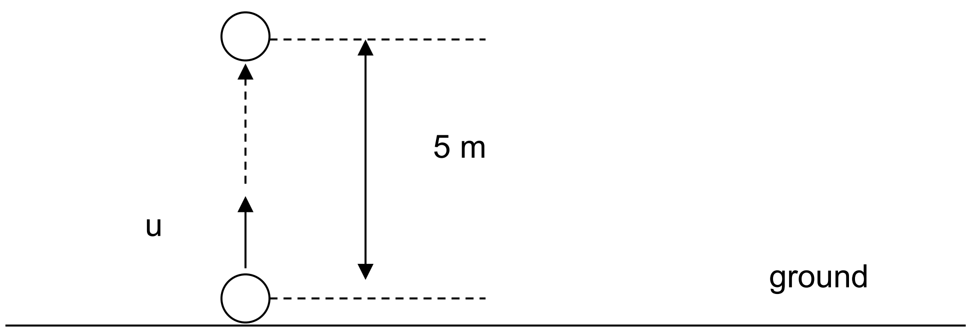


When is the car decelerating?

A AB **B** CD **C** DE **D** EF

( )

2 The diagram below shows a ball of mass 0.50 kg thrown vertically upwards with a velocity of *u*. The ball reaches a maximum height of 5.0 m before it starts falling to the ground.



Assuming that air resistance is negligible, what is the magnitude of u?

A $7.07\ m\ s^{-1}$ **C** $50\ m\ s^{-1}$
B $10\ m\ s^{-1}$ **D** $100\ m\ s^{-1}$

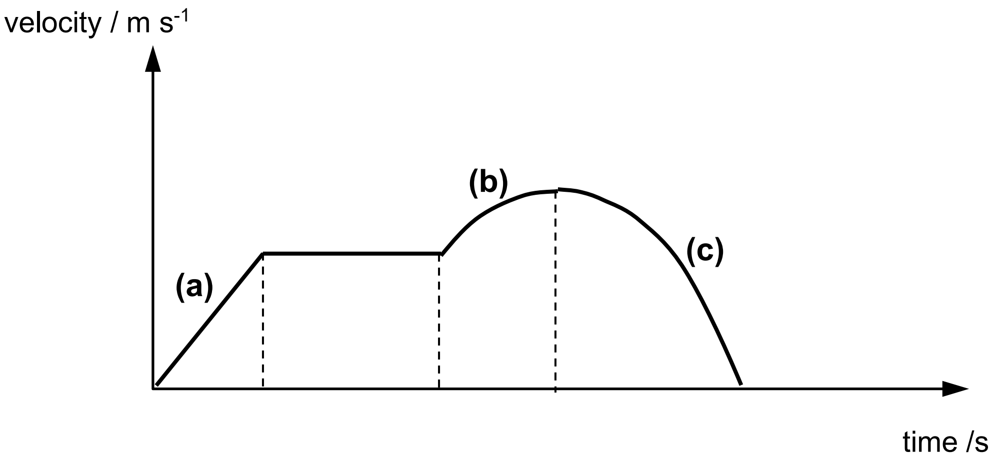
( )

3. Which of the following statements about a body is **correct**?

A A body which is momentarily at rest can have acceleration.
B A body will have acceleration when it is moving with a uniform velocity.
C A body can have a varying speed but no acceleration.
D A body can have a constant velocity and varying speed.

( )

4. A velocity-time graph of an object moving in a straight line is shown below.



Briefly describe the motion shown by the sections labelled.

(a) ……………………………………………………………………………………[1]

(b) ……………………………………………………………………………………[1]

(c) ……………………………………………………………………………………[1]

5 An object was projected up a rough inclined plane at time t = 0 s with a velocity of 3.5 m s^{-1}, and returned to its starting point at t = 1.6 s.

Fig. 5.1 shows how its velocity changes with time.

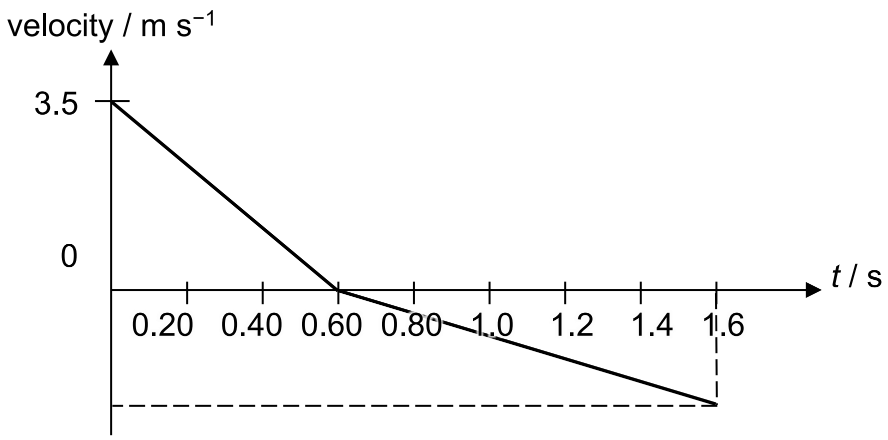


Fig. 5.1

(a) Determine the acceleration of the object between t = 0 s and t = 0.60 s.

acceleration = ... [2]

(b) Determine the maximum distance that the object travelled up the inclined plane.

distance = ... [2]

(c) Determine the object's speed at t = 1.6 s.

speed = ...[2]

6 A man standing on a platform above ground throws a stone up with an initial velocity of 12 m s^{-1}. The stone hits the ground after 3.8 s.

(a) Calculate the velocity at which the stone hits the ground.

velocity = ………………….[2]

(b) Determine the height of the platform from the ground.

height = …………………[2]

Solutions

Q1	Q2	Q3
A	B	A

4

(a) constant acceleration / velocity increasing at a constant rate

(b) decreasing acceleration / velocity increasing at a decreasing rate

(c) increasing deceleration / velocity decreasing at an increasing rate

5

(a) $a = -5.83$ m s^{-2}

(b) max distance = 0.5 × 0.60 × 3.5 = 1.05 m

(c) Since object returns to its starting point,

1.05 = 0.5 × 1.0 × v

speed = 2.1 m s^{-1}

6

(a) 26 m s^{-1} (downwards)

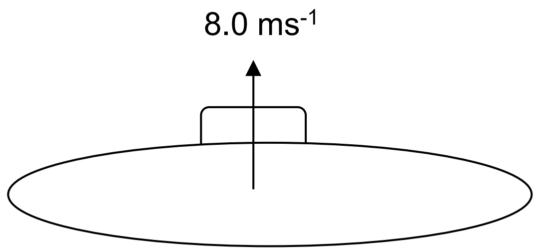
(b) height = 26.6 m

Dynamics

1. A man of mass 60 kg stands on a weighing scale in a lift. When the lift is ascending at a constant acceleration of 1.0 m s^{-2}, what is the reading on the weighing scale?

A 540 N
B 600 N
C 640 N
D 660 N ( )

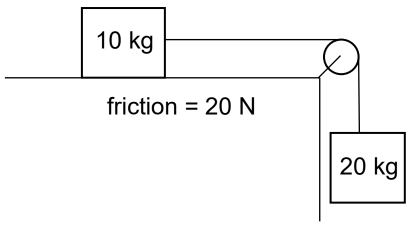
2. The diagram below shows a submarine of mass 1000 kg rising from the sea bed at a constant velocity of 8.0 ms^{-1}.



What is the resultant force acting on the submarine?

A 0 N
B 80 N
C 10 000 N
D 100 000 N ( )

3. A 10 kg mass is initially held at rest on a rough bench and a 20 kg mass is attched to it as shown. A frictional force of 20 N opposes the motion of the 10 kg mass.



What is the acceleration of the 10 kg mass?

A 2.7 m s^{-2}
B 3.0 m s^{-2}
C 4.0 m s^{-2}
D 6.0 m s^{-2} ( )

4. Fig. 4.1 shows a wind blowing from right to left and exerting a constant force of 30 N on a wooden block of mass 2.0 kg. The block is pulled along a rough surface at a constant speed of 60 m s^{-1} by a steady force of 20 N.

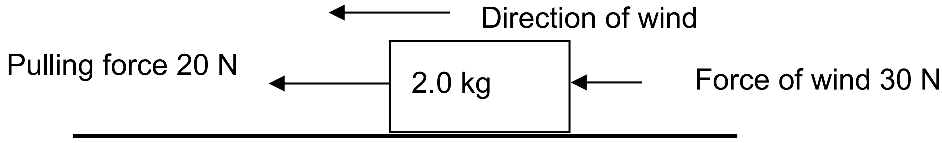


Fig. 4.1

(a) Complete the table for the five forces acting on the block. [2]

Name of force	Size and direction of force
(i) Pulling force	20 N to the left
(ii) Force of wind	30 N to the left
(iii)	
(iv) Normal contact force	20 N upwards
(v)	

(b) After 2.0 s, the pulling force is instantaneously replaced by a constant pushing force of 20 N acting on the same point.

Assume all other forces remain constant,

(i) Calculate the magnitude of the acceleration of the block just after the replacement of the pulling force

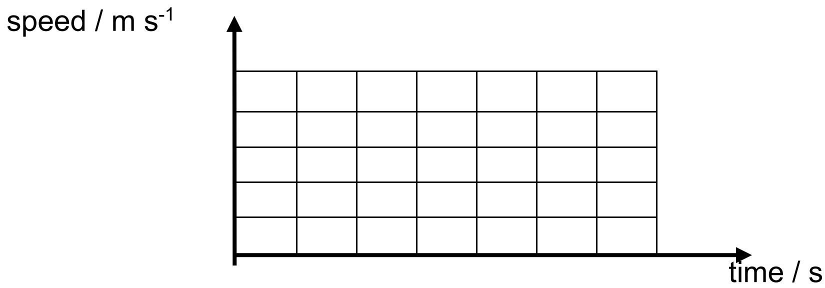
magnitude of the acceleration = ……………..…. [2]

(ii) Describe the speed of the block for the next 3.0 s.

....

....[1]

(c) Draw a speed-time graph for the block during the above 5.0 seconds in the grids below. [3]



5 (a) State Newton's first law of motion.

....

....

.... [2]

(b) Fig 5.1 shows a ball of mass 5.0 kg hanging from a string that is pulled to one side by another horizontal string so that the first string makes an angle of 40° with the horizontal.

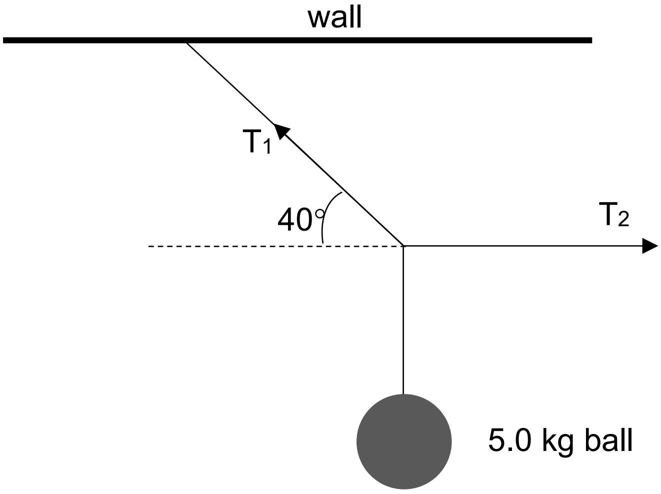


Fig. 5.1

By drawing a scale diagram, determine the magnitude of tensions T_1 and T_2.

T_1 = …………………

T_2 = …………….. [4]

Solutions

Q1	Q2	Q3
D	A	D

4
(a)

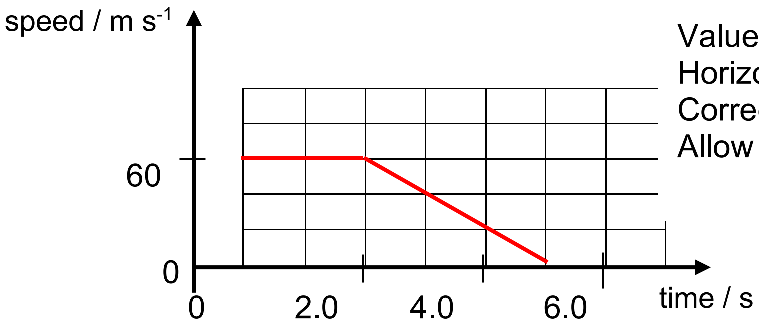
Name of force	Size and direction of force
(iii)Friction	50 N to the right
(v)Weight or Gravitational Force	20 N downwards

(b)
(i)

F = ma
30 – 20 – 50 = 2.0 (a) ❶
a = -20 ms^{-2}
magnitude of a = 20 ms^{-2} ❶

(ii) Speed decreases to zero ❶ (v = u + at = 60 + (-20)(3) = 0)

(c)



Values on both axis ❶
Horizontal line from 0 – 2 s ❶
Correct shape from 2 - 5 s ❶
Allow ecf

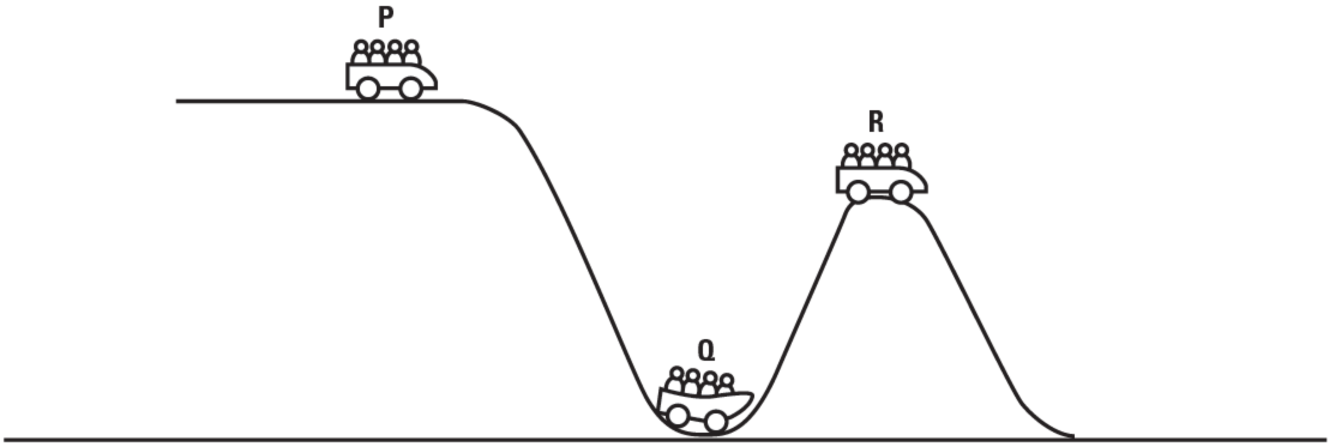
5
(a)

Newton's first law states that
- an object at rest will remain at rest and
- an object in motion will continue in motion at constant speed in a straight line
- unless a resultant force acts on it. [2]

(b)
Correct scale ❶
Correct closed triangle ❶
T_1 = 78 N ❶
T_2 = 60 N ❶

Energy, Work and Power

1 The figure below shows the side view of a smooth roller coaster track. A roller coaster car is released from position P.

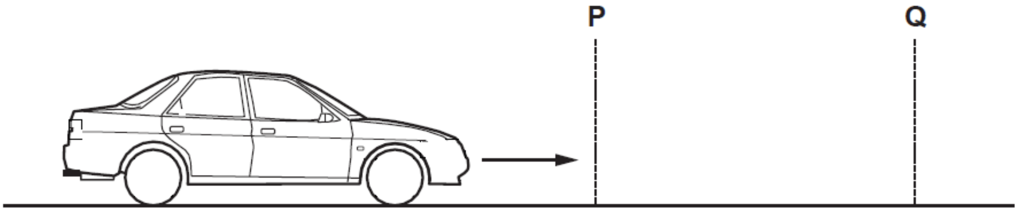


Which of the following statements is/are true?

I The total energy is the same at each of the three positions shown.
II The energy in the kinetic store of the car is greater at Q than at R.
III The energy in the gravitational potential store of the car is greater at R than at P.

A I only **B** I and II **C** I and III **D** I, II and III

2 A car travels along a level road.

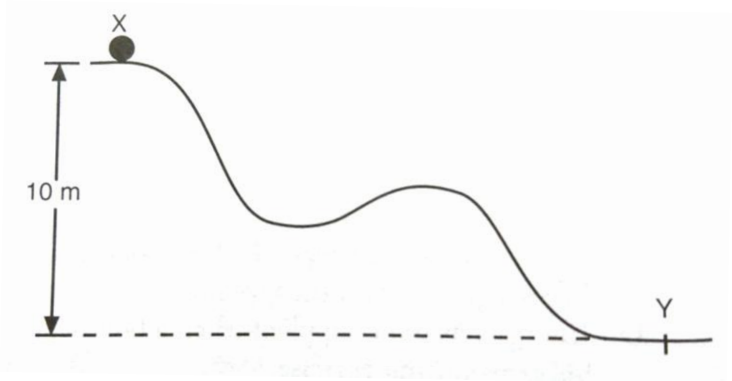


At P, the car has 10 kJ of energy in its kinetic store. Between P and Q the energy input from the petrol is 50 kJ, and the car loses 35 kJ of energy to the environment.

What is the energy in the kinetic store of the car at Q?

A 5 kJ **B** 25 kJ **C** 45 kJ **D** 60 kJ

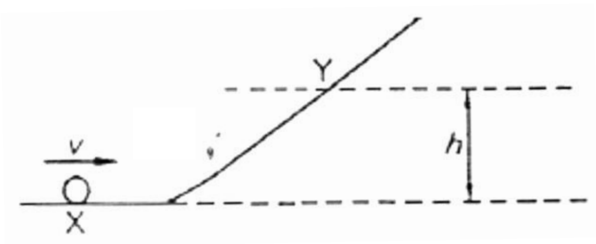
3 A ball bearing is placed at point X on a smooth track as shown in the diagram below. The ball moves from rest down the track and passes a point Y which is 10 m below point X.



What is the speed of the ball at point Y?

A 10.0 m s^{-1} **B** 14.1 m s^{-1} **C** 100 m s^{-1} **D** 141 m s^{-1}

4 An object of mass *m* passes a point X with a velocity *v* and slides up a frictionless incline to stop at point Y which is at a height *h* above X.



A second object of mass *m*/2 passes X with a velocity of *v*/2. To what height will it rise?

A *h*/4 **B** *h*/2 **C** $h/\sqrt{2}$ **D** $h\sqrt{2}$

5 A 5.0 N force is exerted on an object R along a rough surface of 10 m.

What is the gain in energy in the kinetic store of object R if the friction is 2.0 N?

A 10 J **B** 20 J **C** 30 J **D** 40 J

6 A car of mass 1000 kg, initially travelling at 20 m s^{-1}, comes to rest in a certain distance on a level road. What is the work done against friction?

A 0.50 kJ **B** 8.0 kJ **C** 200 kJ **D** 250 kJ

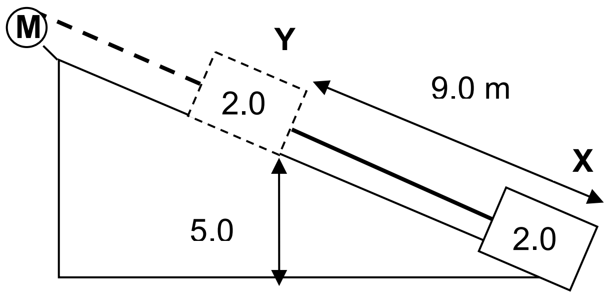
7 A crane needs to lift an object of mass 500 kg through a vertical distance of 15 m. If its average power is 15 000 W, how long will it take to complete the task?

A 0.5 s **B** 0.2 s **C** 2.0 s **D** 5.0 s

8 An electric motor is required to haul a cage of mass 200 kg up a mine shaft through a vertical height of 800 m in 4.0 minutes. What will be its electrical power required if its overall efficiency is 75%?

A 0.89 kW **B** 4.9 kW **C** 5.2 kW **D** 8.9 kW

9 A motor rated at 43 W, pulls a 2.0 kg mass up a ramp at a constant speed. The frictional force between the mass and the ramp is 8.0 N.



What is the efficiency of the motor if the mass takes 4.0 s to move 9.0 from point X to point Y?

A 2.9 % **B** 42 % **C** 48 % **D** 58 %

Answers to MCQ:

1	2	3	4	5	6	7	8	9

10 Fig 10.1 shows an expressway built along the cliff with an emergency escape ramp to allow vehicles to stop even when their brakes fail. The escape ramp is an elevated side track from the main expressway and it is usually laid with small pebbles and stones.

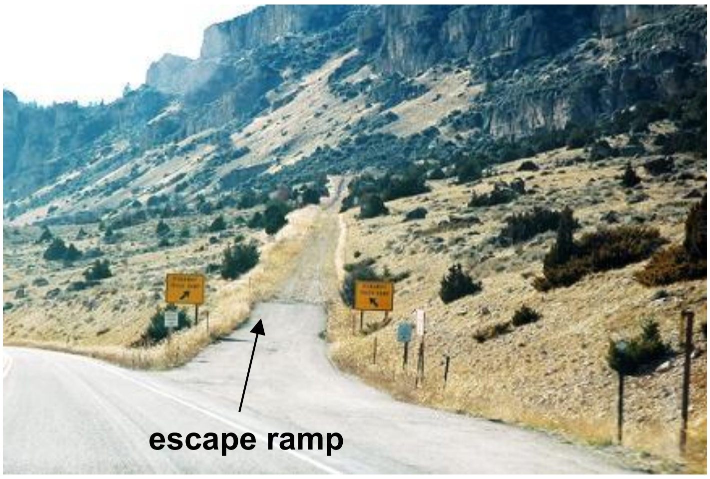


Fig. 10.1

(a) State the *principle of conservation of energy*.

…………………………………………………………………………………….................

…………………………………………………………………………………….................

…………………………………………………………………………………….................

(b) Describe the main energy conversion that takes place as the car drives up the ramp and comes to a stop eventually.

…………………………………………………………………………………….................

…………………………………………………………………………………….................

…………………………………………………………………………………….................

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11 Blocks A and B are connected with a string and placed on a rough slope as shown in Fig. 11.1.

They are initially held at rest.

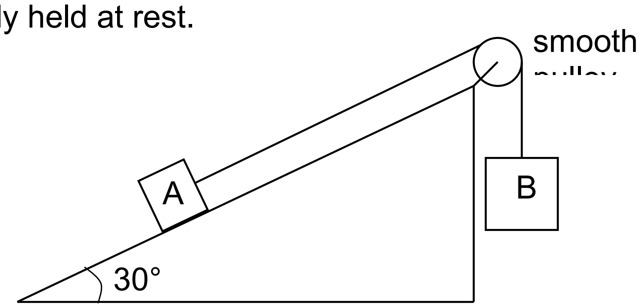


Fig. 11.1

The masses of A and B are 4.0 kg and 10.0 kg respectively. The frictional force between the slope and block A is 5.0 N.
The blocks are released and block B moves down by a height of 2.0 m.

(a) State the energy store(s) that the energy from the gravitational potential store of B is transferred to.

…………………………………………………………………………………………….......

…………………………………………………………………………………………….......

…………………………………………………………………………………………….......

…………………………………………………………………………………………….......

(b) Calculate the loss in gravitational potential energy of block B.

loss in gravitational potential energy = …………………………..

(c) Calculate the gain in gravitational potential energy of block A.

gain in gravitational potential energy = …………………………..

(d) Calculate the work done against friction.

work done against friction = …………………………..

(e) Hence, determine the final speed of blocks A and B.

speed = …………………………..

12 A car of 3000 kg is travelling at a constant velocity of 12.0 m s^{-1} when the driver realises that the braking system has failed. He steers the vehicle into the escape ramp. Its speed is reduced to 2.0 m s^{-1} after it reaches a vertical height of 4.8 m and a distance of 6.9 m along the ramp as shown below. The gravitational field strength is 10 N kg^{-1}.

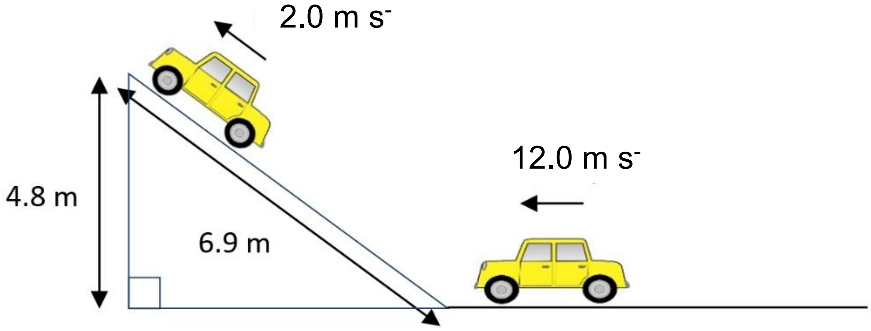


Fig. 12.1

(a) Calculate the loss in energy in the kinetic store of the car as it slows down.

loss in kinetic energy = ……………………..

(b) Calculate the gain in energy in the gravitational potential store of the car when it moves up the vertical height of 4.8 m.

gain in gravitational potential energy = ……………………..

(c) Hence, calculate the work done against friction as the car slows down.

work done against friction = ……………………..

(d) Given that the frictional force along the escape ramp is constant, calculate the frictional force between the ramp and the car.

frictional force = ……………………..

Answers

1 - 5 6 - 9
BBBAC CDDD

10 (a) The principle of conservation of energy states that

- Energy cannot be created or destroyed.
- Energy can only be transferred from one store to another.
- The total energy of an isolated system is constant
  [all 3 must be stated]

(b) Kinetic energy of the car is converted to gravitational potential energy and thermal energy.
Or
Energy from the kinetic store of the car is transferred to its gravitational potential store and the internal store of the surroundings.

11
(a) Energy from the gravitational potential store of B is transferred to the <u>gravitational potential store of A</u> + the <u>kinetic store of A and B</u> + the <u>internal store of the surroundings</u> (due to work done against friction).

(b) loss in g.p.e. B = mgh = 10 × 10 × 2.0 = 200 J

(c)
since the blocks are connected, distance moved *along* the slope by A = 2.0 m
increase in height = 2.0 sin 30°
gain in g.p.e. A = mgh = 4.0 × 10 × 2.0 sin 30° = 40 J

(d)
work done against friction = Fd = 5.0 × 2.0 = 10 J

(e) loss in g.p.e. B = gain in g.p.e. A + WD against friction + gain in k.e. A and B
Gain in k.e. A and B = 200 – 40 – 10 = 150 J
initial k.e. = 0 J (at rest)

$\frac{1}{2}(m_A + m_B)v^2 - 0 = 150$
$\frac{1}{2}(14)v^2 = 150$
$v = 4.63 \text{ m s}^{-1}$

12 (a) Loss in k.e. $= \frac{1}{2} mu^2 - \frac{1}{2} mv^2$

$= \frac{1}{2} m (u^2 - v^2)$

$= \frac{1}{2} \times 3000 \times (12^2 - 2^2) = 210000$ J

(b) Gain in g.p.e. = mgh

$= 3000 \times 10 \times 4.8$

$= 144\ 000$ J

(c) loss in k.e. = gain in g.p.e. + work done against friction

work done against friction = loss in k.e. - gain in g.p.e.

= 210 000 J – 144 000 J

= 66 000 J

(d) work done = F x d

Frictional force F = work done / distance

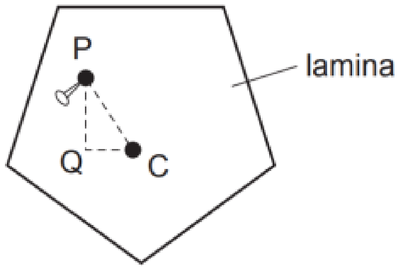
= 66 000 / 6.9

= 9570 N

Turning Effects of Forces

1. A flat lamina is freely suspended from point P. The weight of the lamina is 2.0 N and the centre of gravity is at C.

PC = 0.50 m
PQ = 0.40 m
QC = 0.30 m



The lamina is displaced to the position shown. What is the moment that will cause the lamina to swing?

A 0.60 N m clockwise

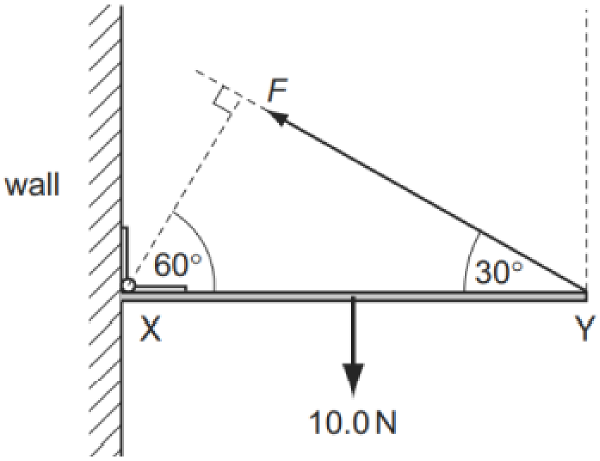
B 0.80 Nm anticlockwise

C 1.0 Nm clockwise

D 1.0 Nm anticlockwise

( )

2. A uniform rod XY of weight 10.0 N is freely hinged to a wall at X. It is held horizontal by a force *F* acting from Y at an angle of 30° to the horizontal, as shown.

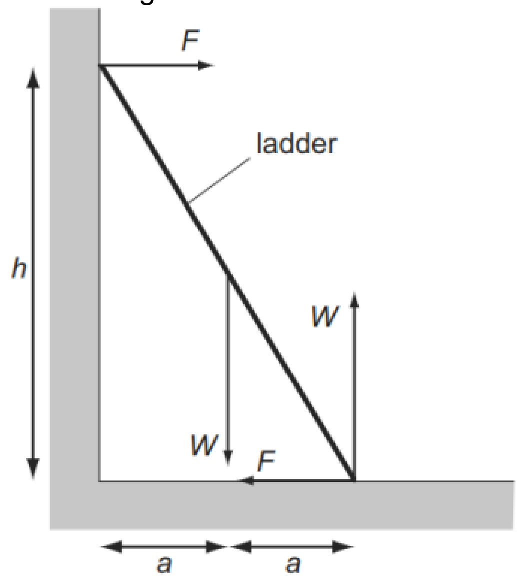


What is the value of *F*?

A 5.0 N **B** 8.7 N **C** 10.0 N **D** 20.0 N

( )

3. A uniform ladder rests against a vertical smooth wall. The bottom of the ladder rests on rough ground. The top of the ladder is at height h above the ground and the foot of the ladder is at a distance 2a from the wall. The diagram shows the forces that act on the ladder.



Which equation is formed by taking moments?

A $Wa + Fh = 2\,Wa$

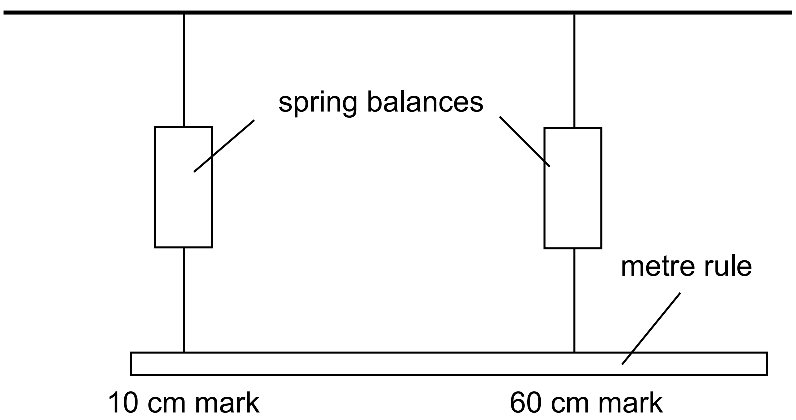
B $Fa + Wa = Fh$

C $Wa + 2Wa = Fh$

D $Wa - 2Wa = 2Fh$

( )

4. A uniform metre rule of mass 0.20 kg is suspended from the ceiling with two identical spring balances as shown in the diagram below. The points of suspension are at the 10 cm and 60 cm mark.

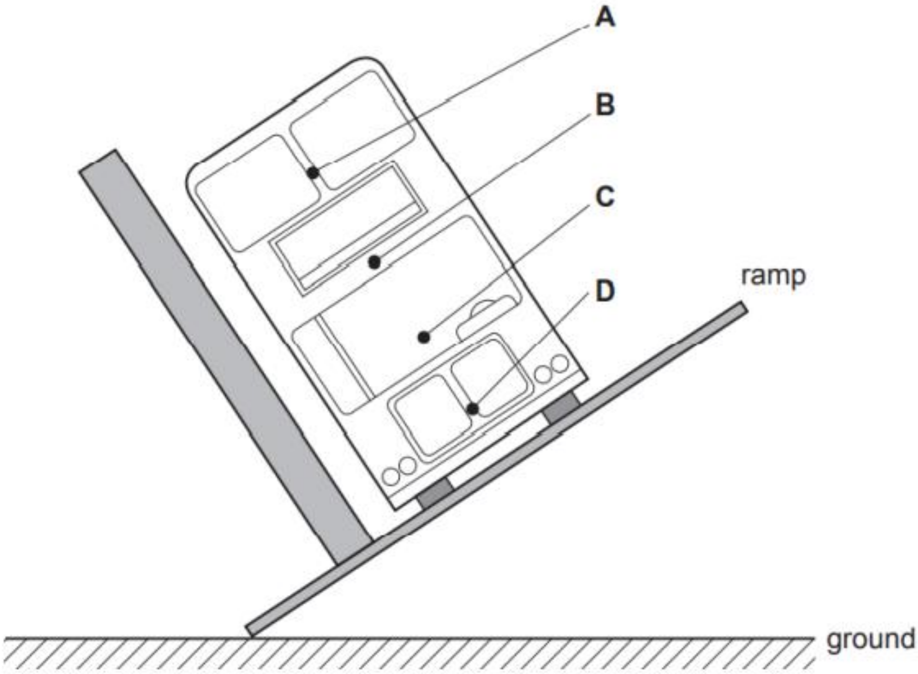


Where should a 0.10 kg mass be placed such that the spring balances have the same reading?

A 5 cm mark **B** 15 cm mark **C** 45 cm mark **D** 55 cm mark

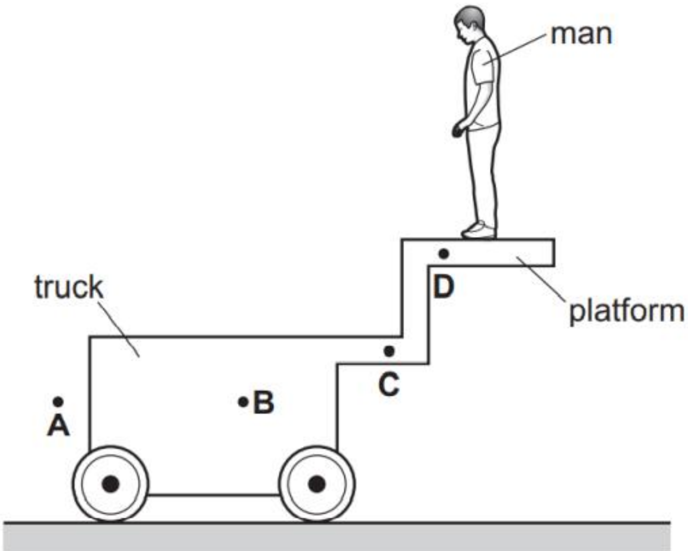
( )

5. The stability of a bus is tested by tilting it on a ramp. The diagram shows a bus that is just about to topple over. Where is the centre of gravity of the bus?



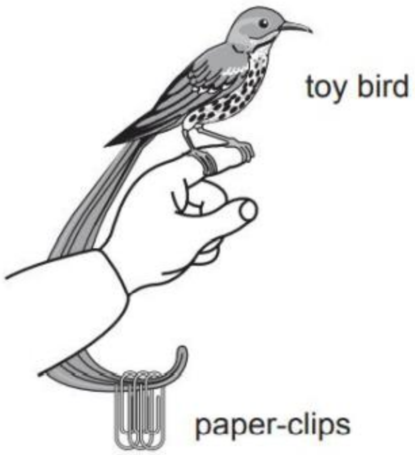
( )

6. A heavy truck on wheels has a platform attached to it. A man stands on the platform. The truck does not fall over. Which position A, B, C or D could be the centre of gravity of the whole system (truck, platform and man)?



( )

7. A girl uses paper-clips to balance a toy bird on her finger as shown.



What is the effect of the paper-clips?

A They help to raise the centre of gravity above her finger.

B They help to raise the centre of gravity to her finger.

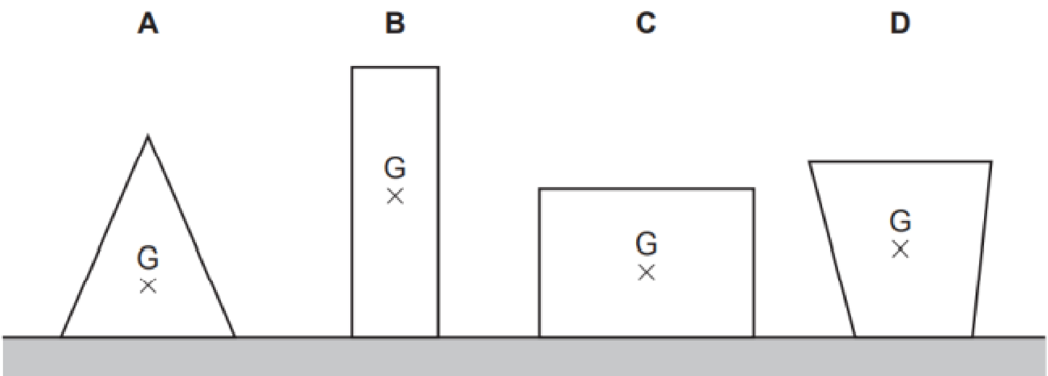
C They help to lower the centre of gravity below her finger.

D They do not affect the centre of gravity but increase the weight.

( )

8. Four objects of equal mass rest on a table. The centre of gravity of each object is labelled G.

Which object is the least stable?



( )

9. A 2.0 m long uniform beam of mass 50 kg supports an object of mass 150 kg which is positioned 50 cm from one end. The beam is placed on two supports A and B as shown in Fig. 9.1.

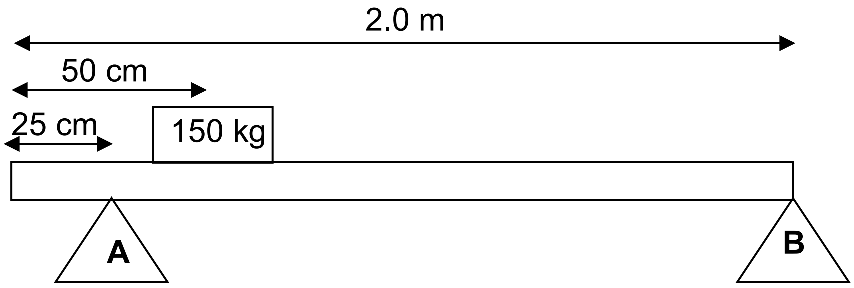


Fig. 9.1

(a) State what is meant by the moment of a force.

....

.... [1]

(b) Calculate the normal contact forces acting on the beam by supports A and B.

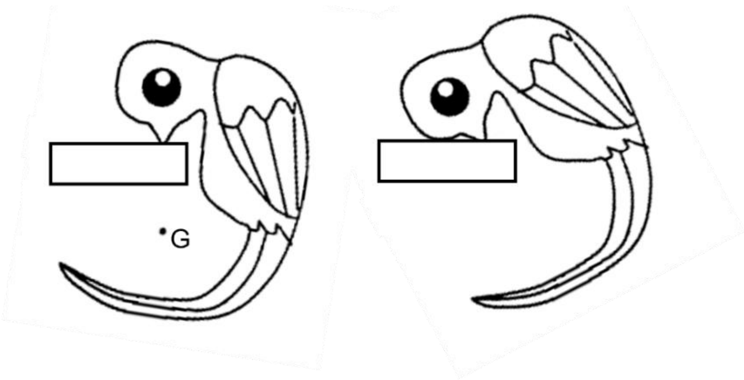
normal contact force by support A = ……………………………………

normal contact force by support B = ………………………………… [4]

(c) The 150 kg is then shifted to a new position. Determine the position of the 150 kg mass from the left end of the beam for the beam to *just* start tilting about pivot A

distance = ………………………………… [2]

10 The diagrams below illustrate both the rest position (left) and the displaced position (right) of a weighted toy. G is its centre of gravity.



Explain why the toy returns to its rest position when displaced and released.

....

....

....

....[2]

Solutions

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
A	C	A	A	C	B	C	B

9(a)

Moment of a force is defined as the product of a force and the perpendicular distance from the line of action of the force to the pivot point

(b)

Applying principle of moments about pivot A,

Total anticlockwise moments = Total clockwise moments
RB(175) = 150(10)(25) + 50(10)(75) ❶
RB = 428.57 N = 429 N ❶

Total Upward Forces = Total Downward Forces
RA + 428.57 = 1500 + 500 ❶
RA = 1571 N = 1570 N (3 s.f.) ❶

(c)

R_B = 0 N when just about to tilt
Applying principle of moments about pivot A

1500(x) = 500(75) ❶
x = 25.0 cm
distance from left end of beam = 25.0 cm – 25.0 cm = 0.0 cm

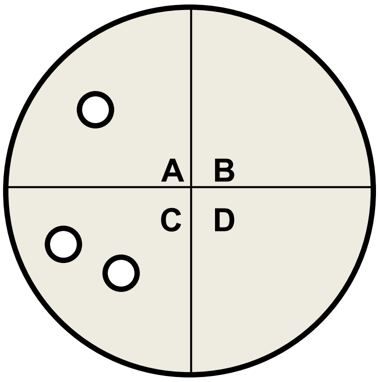
10

When the toy is displaced, its centre of gravity lies on the right of the pivot, therefore the weight produces a clockwise moment. This causes the toy to rotate clockwise back to its rest position.

Turning effect of forces, Pressure

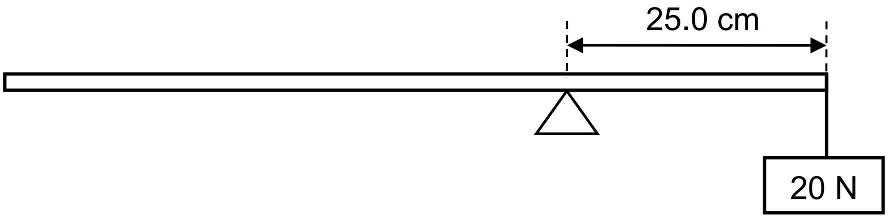
1 A plane circular lamina made of a homogenous material has three holes drilled through it.

At which quadrant is the centre of gravity of the lamina?



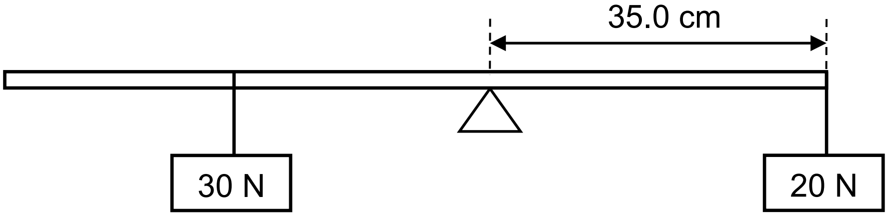
2 A non-uniform rod weighing 50 N is pivoted at 25.0 cm from its right end.

It is balanced by a 20 N weight.



The position of the pivot is then shifted 10.0 cm to the left.

The system is now balanced by hanging a 30 N weight on the rod as shown in the diagram below (not drawn to scale).



How far from the pivot should the 30 N weight be hung?

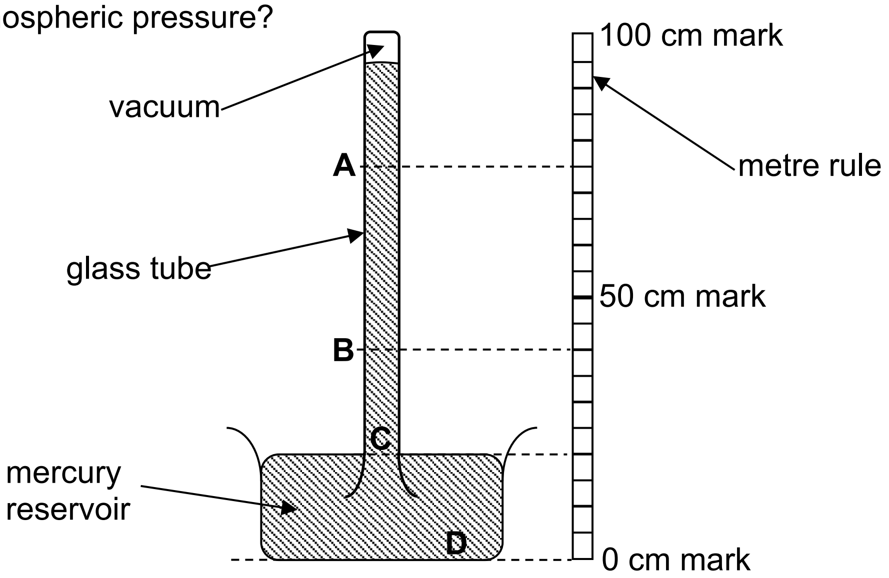
A 10 cm **B** 12 cm
C 23 cm **D** 35 cm

3 In a large tank of liquid, at a point 180 cm below the surface of the liquid, the pressure due to the liquid alone is 100 kPa.

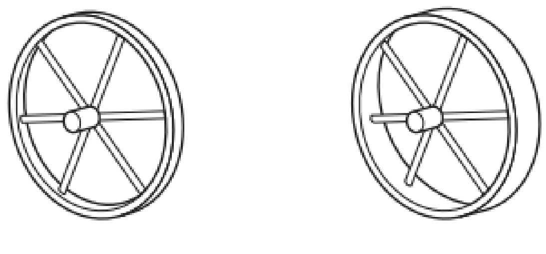
The density of the liquid is

A 0.556 kg m^{-3}
B 55.6 kg m^{-3}
C 556 kg m^{-3}
D 5560 kg m^{-3}

4 The diagram shows a simple mercury barometer.
At which level of the barometer, **A**, **B**, **C** or **D**, is the pressure 20 cm Hg less than the atmospheric pressure?



5 A farmer has two carts. The carts have the same weight, but one has four narrow wheels and the other has four wide wheels.

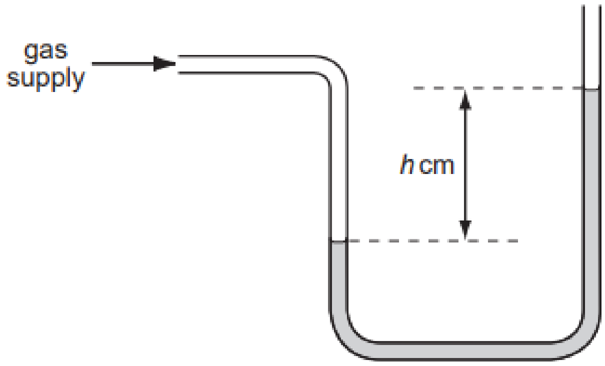


narrow wheel wide wheel

In rainy weather, which cart sinks less into soft ground, and why?

	cart wheels	reason
A	narrow	greater pressure on the ground
B	narrow	less pressure on the ground
C	wide	greater pressure on the ground
D	wide	less pressure on the ground

6 A water manometer is used to measure the pressure of a gas supply to a house. It gives a reading of h cm of water.



Why is it better to use water rather than mercury in this manometer?

A *h* would be too large if mercury were used.
B *h* would be too small if mercury were used.
C The tube would need to be narrower if mercury were used.
D The tube would need to be wider if mercury were used.

7 **(a)** State the *principle of moments*.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………[1]

Fig. 7.1 shows a baby mobile that hangs by a string from the ceiling. Objects P, Q, R and S hang from 3 rods. The toy is completely stationary and the rods are horizontal. The weights of the strings and the rods may be neglected.

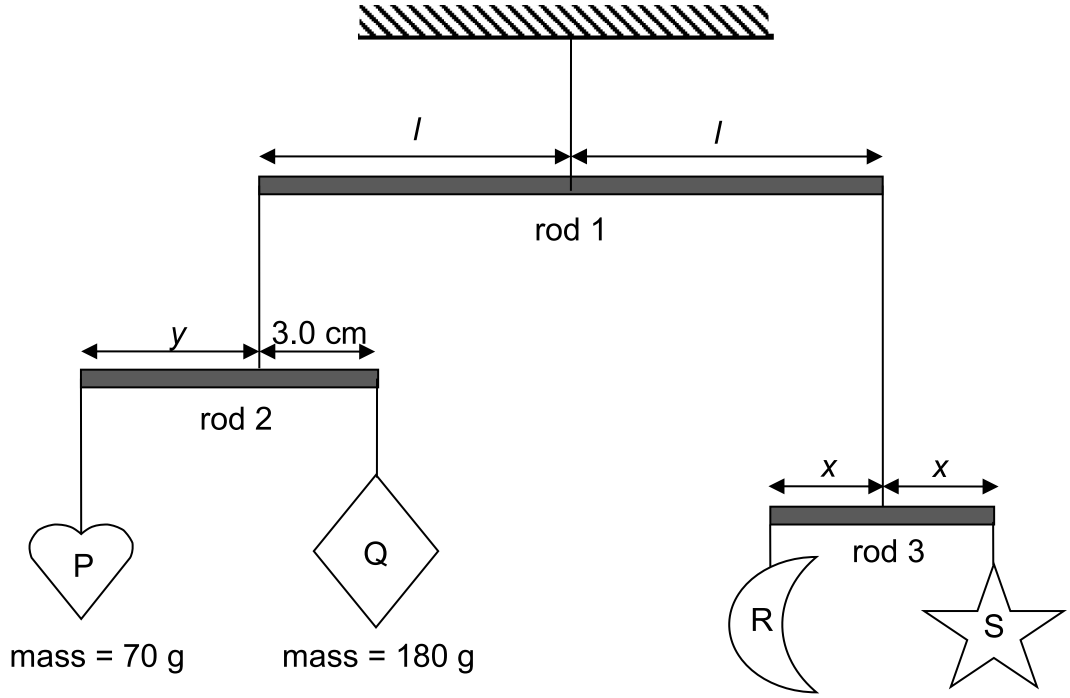


Fig. 7.1

(b) Calculate length *y*.

length *y* = …………………… [2]

(c) Determine the mass of R and S.

mass of R = ……………………; mass of S = ……………………. [2]

(d) If object R drops off, state what will happen to rod 1 and rod 3.

rod

1: …………………………………………………………………………………………

…………………………………………………………………………………………… [1]

rod

3: …………………………………………………………………………………………

……………………………………………………………………………………………[1]

8 A bubble of gas rises 40.0 m from a diver to the surface of a lake, as shown in Fig. 8.1.

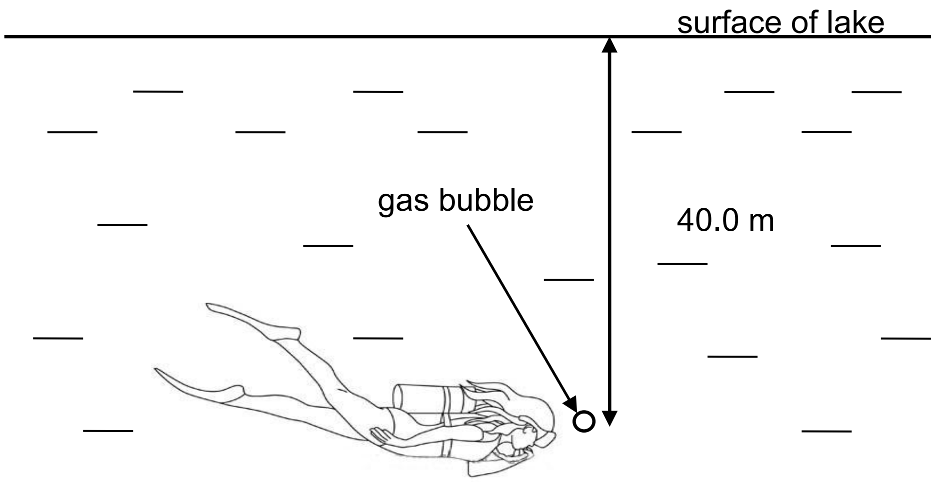


Fig. 8.1

(a) If atmospheric pressure is 101 kPa and the density of the lake water is 1000 kg m^{-3}, calculate the air pressure inside the bubble at the depth of 40.0 m in Pascal.

air pressure =………………………[3]

~~**(b)** State and explain how the volume of the bubble will change as it rises to the surface of the lake.~~

~~……………………………………………………………………………………………~~

~~……………………………………………………………………………………………~~

~~……………………………………………………………………………………………[2]~~

9 A hydrogen filled balloon is used to support a non-uniform beam PQ on a smooth pivot at the mid-point of the beam as shown in Fig. 2.1.

PQ is 100 cm long and weighs 2.5 N. The tension in the string T is 0.80 N when the beam is resting horizontally.

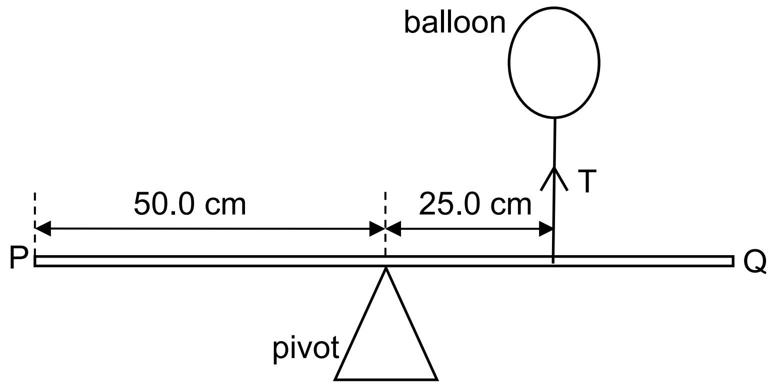


Fig. 2.1

(a) The volume of the balloon is 950 cm^3 and the density of hydrogen is 8.99×10^{-5} g cm^{-3}. Calculate the mass of the hydrogen.

mass of hydrogen = ……………………[2]

(b) Calculate the distance of the centre of gravity of the beam from P.

distance of the centre of gravity from P = ………………….[3]

10 Fig. 10.1 below shows a tall cylinder with two outlets X and Y, which is kept filled with water. The path of the water from outlet X is shown.

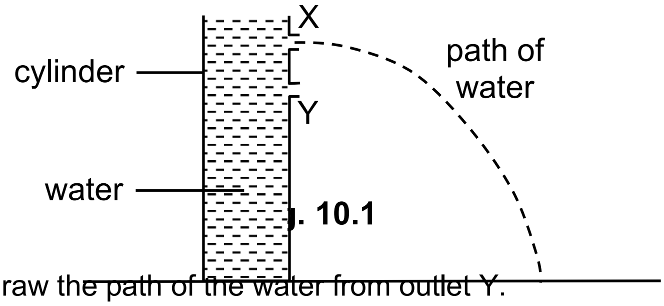


Fig. 10.1

(a) On Fig. 10.1, draw the path of the water from outlet Y. [1]

(b) State and explain what difference would be observed if the water was replaced with a liquid of lower density.

....

....

....

.... [2]

11 A garden pond contains a small fountain. An electric pump in the water causes the water to rise above the surface of the pond, as shown in Fig. 11.1.

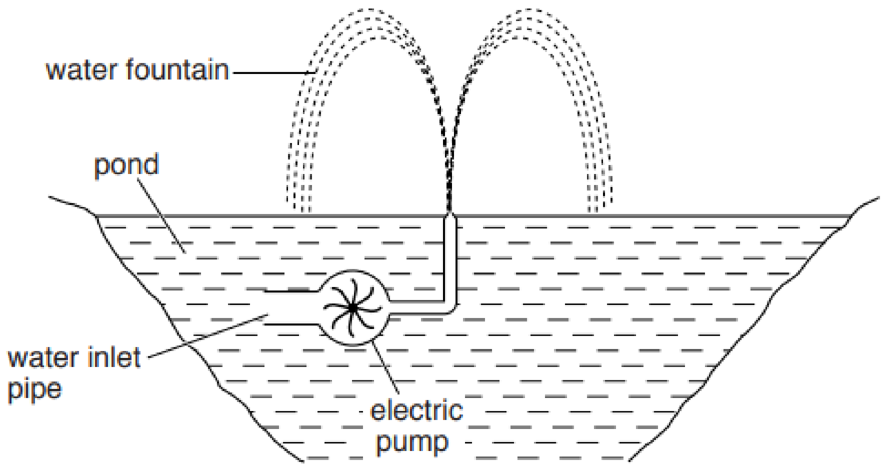


Fig. 11.1

(a) The pressure of the water in the pond increases with depth.

(i) Explain what is meant by pressure.

....

....[1]

(ii) Explain why the pressure below the surface of the water increases with depth.

……………………………………………………………………………………

……………………………………………………………………………………[1]

(b) Describe the energy changes within the pump.

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

……………………………………………………………………………………………… [3]

(c) A volume of 0.78 m^3 of water passes through the pump in one hour. The density of water is 1000 kg m^{-3}.

(i) Calculate the mass of water that passes through the pump in one hour.

mass = ………………..[2]

(ii) The water rose 1.5 m. The gravitational field strength g is 10 N/kg. Calculate the useful work done in one hour raising the water to the top of the fountain.

work done = ………………………….[2]

(iii) Calculate the minimum power output of the pump.

power = ………………………[2]

12 Fig. 12.1 shows a thin sheet of metal suspended from a hole in one corner at A. The weight of the metal is 0.10 N and the centre of mass is at B. The diagram is drawn full scale.

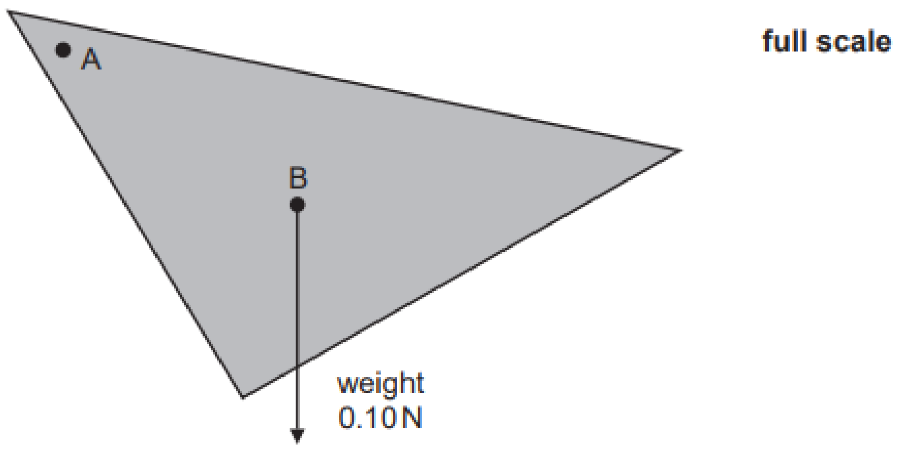


Fig. 12.1

(a) The sheet turns because of the moment of the weight about point A. Using a distance measured on Fig. 12.1, calculate the moment of the weight about point A. Indicate the distance you measured clearly on Fig. 12.1.

Moment = ………………………. [3]

(b) Fig. 12.2 and Fig. 12.3 show a thick piece of wood with one corner on a table. Fig. 12.4 shows the same piece of wood balanced on the table. B is the centre of gravity.

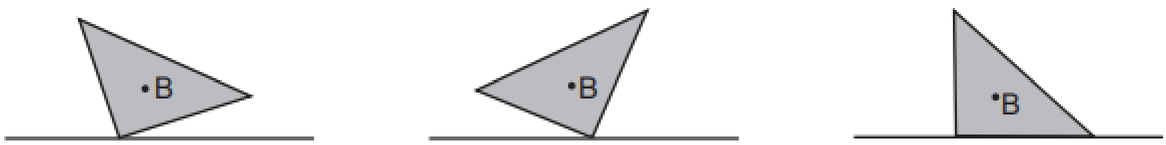


Fig. 12.2 **Fig. 12.3** **Fig. 12.4**

(i) Explain why in Fig. 12.2 the piece of wood falls to the right and in Fig. 12.3 it falls to the left.

………………………………………………………………………………

………………………………………………………………………………

………………………………………………………………………………

……………………………………………………………………………[2]

(ii) Explain why the piece of wood in Fig. 12.4 does not fall over.

………………………………………………………………………………

……………………………………………………………………………[1]

(iii) Suggest how the thickness of the wood in Fig. 12.4 affects its maximum angle of tilt.

…………………………………………………………………………………………

……………………………………………………………………………………….[1]

Answers:

MCQs 1--------_-6

BCD BDB

Structured Questions:

7(a) For a system/body/object in equilibrium, the clockwise moments about any point must equal the anti-clockwise moments about the same point. [1]

7(b) Applying principle of moments, $3.0 \times 180 = y \times 70$ [1]

$y = 7.7$ cm [1]

7(c) Total mass of R and S = 180 + 70 = 250 g [1]

R and S must be of the same mass.

Therefore, mass of R = mass of S = 250 ÷ 2 = 125 g [1]

7d) Rod 1: Rod 1 will turn in the anti-clockwise direction. [1]

Rod 3: Rod 3 will turn in the clockwise direction. [1]

8(a) Pressure due to water = 40.0 × 1000 × 10 = 400000 Pa [1]

Pressure in bubble = pressure due to atmosphere + pressure due to water

= 400 000 + 101 000 [1]

= 501 000 Pa or 501 kPa [1]

8(b) Volume of the bubble will <u>increase</u>. [1]

As <u>the bubble rises</u>, the <u>pressure in the bubble decreases</u>, according to <u>Boyle's Law</u>, the <u>volume</u> <u>will then increase</u> accordingly. [1]

9(a) $m = \rho \times v$ $= 8.99 \times 10^{-5}$ g cm^{-3} x 950 cm^3

$= 8.54 \times 10^{-2}$ g [2]

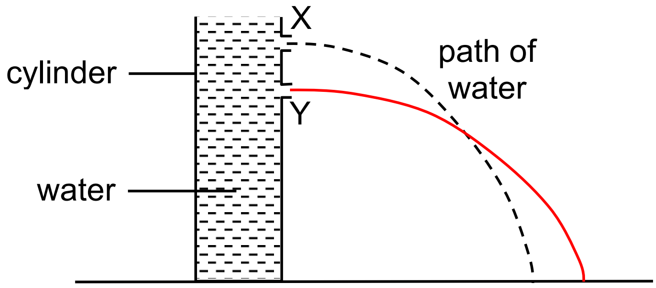
(b) Taking moments about the pivot,

2.5 N x d cm = 0.80 N x 25 cm [1]

d = 8.0 cm [1]

distance of the centre of gravity from P = 50.0 + 8.0 = 58.0 cm [1]

10 (a) correct path of water from Y



(b) Path of liquid would hit the surface nearer to the cylinder.
Pressure is proportional to density of the liquid, hence pressure decreases when density decreases.

11 (a) (i) Pressure is the force acting normally per unit area [1]
(a) (ii) As the depth increases, there is more water above [1] and that exerts a larger weight [1]

(b) electrical energy at start of process [1] kinetic energy of water/ turbine/blade produced [1] some heat energy / thermal energy / internal energy produce [1]
(c) (i) mass = 1000 kg m^{-3} x 0.78 m^3 [1] = 780 kg [1]
(c)(ii) work done = mgh = 780(10)(1.5) [1] = 11700 J or 12000 J [1]
(c)(iii) power = 11700 / 60^2 [1] = 3.25 [1]

12a 3.0 cm x 0.10 N = 0.3 N/ cm
12bi In Fig. 12.2, the weight of the wood which acts through the centre of mass causes a clockwise turning moment about the pivot. Hence, the piece of wood rotates clockwise and falls to the right
In Fig. 12.3, the weight of the wood causes an anti-clockwise turning moment about the pivot. Hence, the piece of wood rotates anti-clockwise and falls to the left.
12bii The weight of the wood lies within the base and does not give rise to any turning moment. Hence, the piece of wood remains in equilibrium.
12biii The thickness of wood will not affect the position of the centre of gravity and hence, does not affect the maximum angle of tilt.