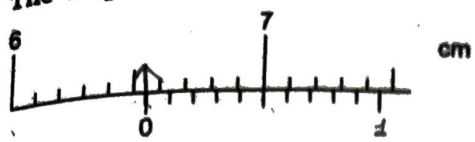
1. **The diagram shows a vernier scale.**



What is the reading on the vernier scale?

A 6.50 cm **B** 6.55 cm
C 7.00 cm **D** 7.05 cm

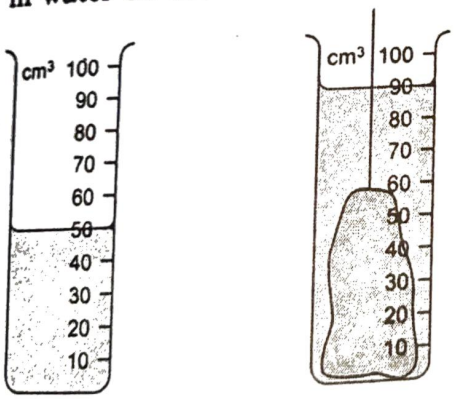
[J06/P1/Q3]

2. **The inertia of a body is its resistance to changes in motion.**
Which property is a measure of the body's inertia?

A its density
B its mass
C the height of its sides
D the size of its base

[J06/P1/Q6]

3. **An object of mass 100g is immersed in water as shown in the diagram.**

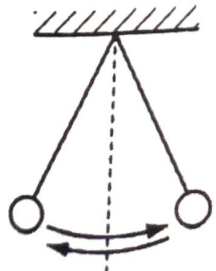


What is the density of the material from which the object is made?

A 0.4 g/cm³ **B** 0.9 g/cm³
C 1.1 g/cm³ **D** 2.5 g/cm³

[J06/P1/Q7]

4. **A pendulum swings backwards and forwards passing through Y, the middle point of the oscillation.**



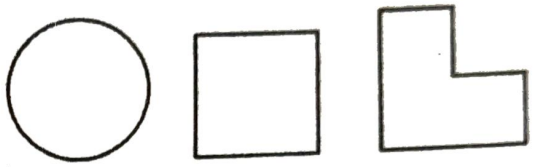
The first time the pendulum passes through Y, a stopwatch is started. The twenty-first time the pendulum passes through Y, the stopwatch is stopped. The reading is *T*.

What is the period of the pendulum?

A *T*/40 **C** *T*/20
B *T*/21 **D** *T*/10

[N06/P1/Q1]

5. **Three objects are cut from the same sheet of steel. They are different shapes but they all have the same mass.**



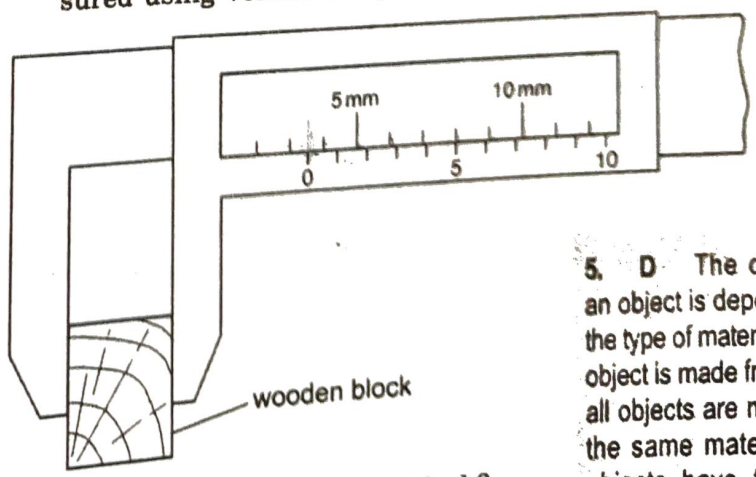
disc square L-shape

Which object has the greatest density?

A the disc
B the L-shape
C the square
D all have the same density

[N06/P1/Q6]

6. **The width of a wooden block is measured using vernier calipers.**



What is the width of the block?

A 3.5 mm **B** 5.3 mm
C 8.0 mm **D** 8.5 mm

[J07/P1/Q1]

1. **B** main scale reading = 6.5 cm
Vernier scale reading = 0.05 cm
Final reading = 6.55 cm

2. **B** It is a fact that inertia ∝ mass.

3. **D** $\text{density} = \frac{\text{mass}}{\text{volume}}$

$= \frac{100}{40} = 2.5\ \text{g/cm}^3$

4. **D** The period is the time taken for the pendulum to complete one oscillation. The shortest time taken for pendulum to go from Y to Y again is half a period. Since the counting started at 1, the total no of half-periods is (21 – 1) = 20. So total no. of periods is 10.

5. **D** The density of an object is dependent on the type of material that the object is made from. Since all objects are made from the same material, all 3 objects have the same density.

6. **A** Reading = main reading + vernier reading = 3 + 0.5 = 3.5 mm

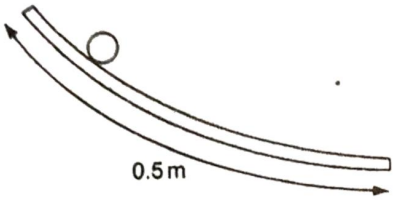
7. A student does an experiment to estimate the density of an irregularly-shaped stone.

Which items of equipment are needed?

A a balance and a measuring cylinder containing water
B a balance and a ruler
C a ruler and a measuring cylinder containing water
D only a measuring cylinder containing water

[J07/P1/Q6]

8. In an experiment, a ball is rolled down a curved track that is about half a metre long.



Which measuring device should be used to measure the length accurately?

A metre rule
B micrometer
C tape measure
D vernier calipers

[N07/P1/Q1]

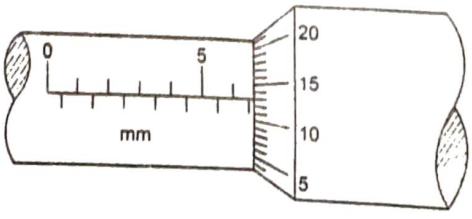
9. A body of mass 10 kg falling freely in the gravitational field close to the Moon's surface has an acceleration of 1.6 m/s^2.

What is the gravitational field strength on the Moon?

A 0 N/kg **B** 1.6 N/kg
C 10 N/kg **D** 16 N/kg

[N07/P1/Q6]

10. What is the reading on this micrometer?

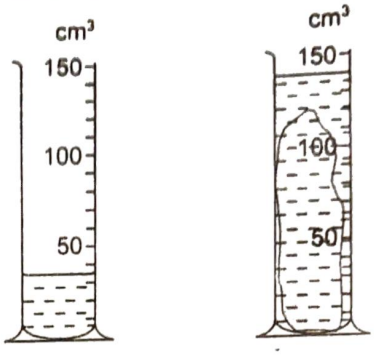


A 5.43 mm **B** 6.63 mm
C 7.30 mm **D** 8.13 mm

[J08/P1/Q1]

11. A lump of metal has a mass of 210 g. It is lowered into a measuring cylinder containing water.

The level of the water rises from 35 cm^3 to 140 cm^3.



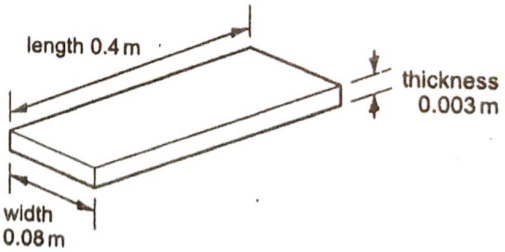
What is the density of the metal?

A 0.67 g/cm^3 **B** 1.5 g/cm^3
C 2.0 g/cm^3 **D** 6.0 g/cm^3

[J08/P1/Q6]

12. A manufacturer needs to measure accurately the dimensions of a wooden floor tile.

The approximate dimensions of the tile are shown.



Which instruments measure each of these dimensions accurately?

	length	thickness	width
A	metre rule	micrometer	vernier calipers
B	metre rule	vernier calipers	micrometer
C	micrometer	metre rule	vernier calipers
D	vernier calipers	micrometer	metre rule

[N08/P1/Q1]

MCQ Answers

7. **A** density = $\frac{\text{mass}}{\text{volume}}$

A balance is needed to find the mass of the stone and a measuring cylinder to measure the volume of the stone.

8. **C** A metre rule cannot measure accurately the length of a curved track. Similarly a micrometer or vernier callipers also cannot measure this length accurately and moreover the length of the track is too long to be measured with them. A measuring tape being flexible can easily measure the length of the curved track accurately.

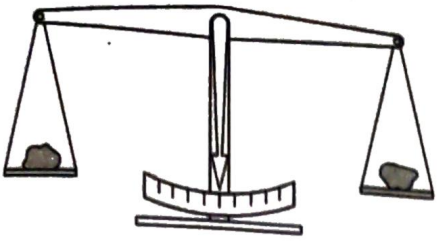
9. **B** The gravitational field strength = $\frac{\text{weight}}{\text{mass}} = \frac{16\text{ N}}{10\text{ kg}} = 1.6\text{ N/kg}$

10. **B** Reading = 6.5 + 0.13 = 6.63 mm.

11. **C** density = $\frac{\text{mass}}{\text{volume}}$

$= \frac{210\text{ g}}{105\text{ cm}^3} = 2.0\text{ g/cm}^3$.

13. The diagram shows two objects on a beam balance in equilibrium.

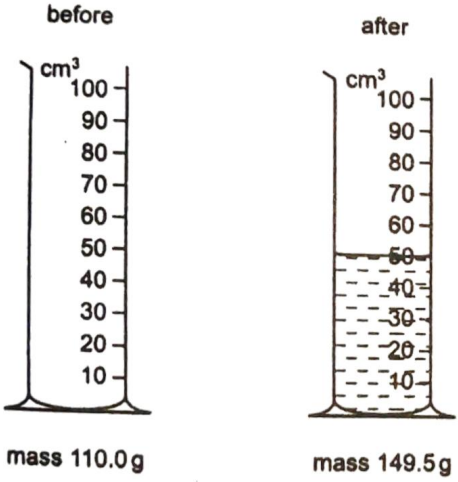


Which need not be the same?

A the masses of the two objects
B the moments about the pivot of the two objects
C the volumes of the two objects
D the weights of the two objects

[N08/P1/Q5]

14. The mass of a measuring cylinder is measured before and after pouring a liquid into it.



What is the density of the liquid?

A 0.79 g/cm³
B 1.3 g/cm³
C 1.4 g/cm³
D 2.2 g/cm³

[N08/P1/Q6]

15. Which instrument is most easily used to measure the internal diameter of a pipe?

A manometer
B measuring cylinder
C micrometer
D vernier calipers

[J09/P1/Q1]

16. A measuring cylinder contains 118 cm³ of water. When a small object is fully immersed in the water, the reading goes up to 132 cm³. The object has a mass of 42 g.
What is the density of the object?

A $\frac{14}{42}$ g/cm³
B $\frac{42}{14}$ g/cm³
C $\frac{42}{118}$ g/cm³
D $\frac{132}{42}$ g/cm³

[J09/P1/Q7]

17. Vernier calipers read to one tenth of a millimetre.
Which reading shows this precision?

A 3.3 cm **B** 3.31 cm
C 3.310 cm **D** 3.312 cm

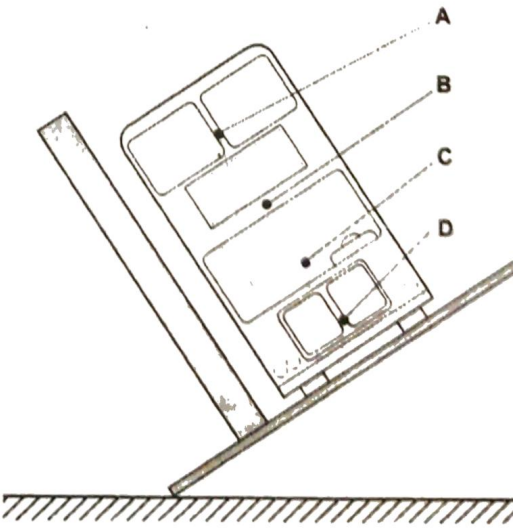
[N09/P1/Q1]

18. A room measures 4.0m × 3.0m × 2.0m. The density of the air in the room is 1.3 kg/m³.
What is the mass of air in the room?

A 0.054 kg **B** 18 kg
C 24 kg **D** 31 kg

[N09/P1/Q7]

19. 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 mass of the bus?



[N09/P1/Q8]

20. Power is measured in watts.

What is the correct symbol for millions of watts?

A mw **B** mW
C Mw **D** MW

[J10/P1/Q2]

21. A passenger is sitting in an aeroplane, which takes off and climbs to 10 000 m.

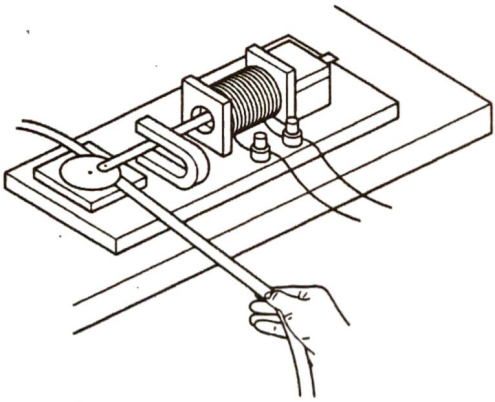
During this time, what happens to the mass and to the weight of the passenger?

	mass	weight
A	decreases	decreases
B	increases	increases
C	unchanged	decreases
D	unchanged	increases

[J10/P1/Q6]

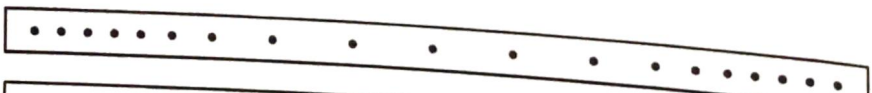
22. A student pulls a piece of tape through a ticker-tape timer. Every 0.02 s, the timer prints a dot on the tape.

First the tape is pulled quickly, then slowly, then quickly again.



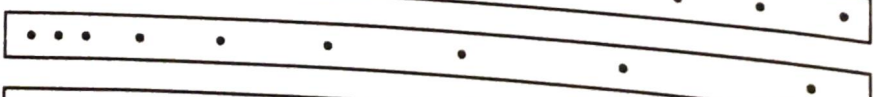
Which piece of tape does the student obtain?

A

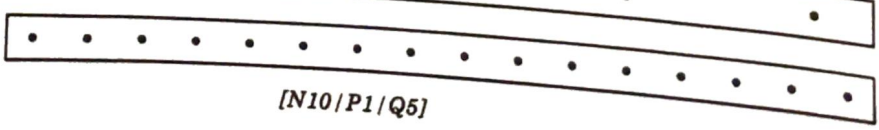


B

C

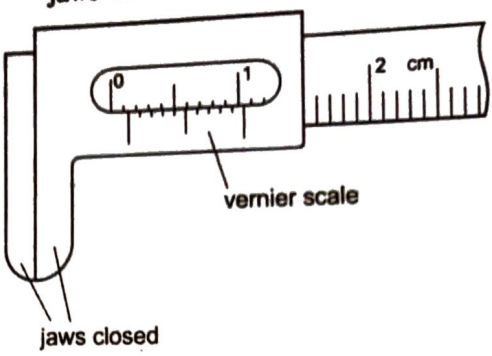


D



[N10/P1/Q5]

23. Vernier calipers are shown with the jaws closed.



What is the zero error?

A 0.04 cm **B** 0.05 cm
C 0.14 cm **D** 0.15 cm

[N10/P1/Q4]

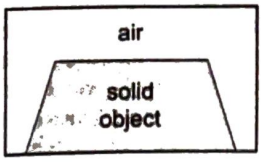
24. A person of weight 600 N at the bottom of a mountain climbs to the top. The gravitational field strength changes from 10.00 N/kg at the bottom to 9.97 N/kg at the top. His mass is unchanged as he climbs.

What are his mass and his weight at the top of the mountain?

	mass at top of mountain/kg	weight at top of mountain/N
A	60.0	598
B	60.0	600
C	60.1	598
D	60.1	600

[N10/P1/Q9]

25. A box has an internal volume of 1000 cm^3. When a solid object is placed in the closed box, the volume of air in the box is 520 cm^3.
The density of the object is 8.00 g/cm^3.



What is the mass of the object?

A 60.0 g **B** 3840 g
C 4160 g **D** 8000 g

[N10/P1/Q11]

26. What is the correct unit for the quantity shown?

	quantity	unit
A	electromotive force (e.m.f.)	N
B	latent heat	J
C	pressure	kg/m^3
D	weight	kg

[J11/P1/Q1]

27. A plumber measures, as **accurately** as possible, the length and internal diameter of a straight copper pipe.
The length is approximately 80 cm and the internal diameter is approximately 2 cm.
What is the best combination of instruments for the plumber to use?

	internal diameter	length
A	rule	rule
B	rule	tape
C	vernier calipers	rule
D	vernier calipers	tape

[J11/P1/Q2]

28. A student collects stones and finds their density.
Which apparatus is needed to measure the mass and the volume of the stones?

	mass	volume
A	newton meter	measuring cylinder and water
B	newton meter	ruler and calipers
C	top-pan balance	measuring cylinder and water
D	top-pan balance	ruler and calipers

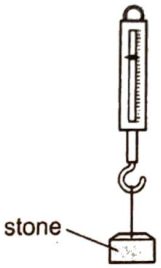
[J11/P1/Q8]

29. A balloon filled with air is gently heated.
What happens to the mass and the density of the air inside the balloon?

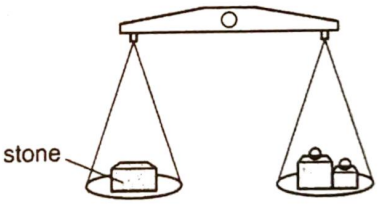
	mass	density
A	decreases	decreases
B	decreases	stays the same
C	stays the same	decreases
D	stays the same	stays the same

[J11/P1/Q15]

30. The weight of a stone is found using a newton meter, and its mass is found using a pan balance.



newton meter



pan balance

The experiment is carried out on the Earth and on the Moon.
For each meter, is its reading the same or different on the Earth and on the Moon?

	reading on newton meter	reading on pan balance
A	different	different
B	different	same
C	same	different
D	same	same

[N11/P1/Q5]

Question 1

A student measures the mass and the volume of four samples of rock A, B, C and D. The results are shown in Fig. 2.1.

	A	B	C	D
mass / g	101	202	448	4508
volume / cm^3	22	44	80	978

Fig. 2.1

(a) (i) Describe in detail how a measuring cylinder is used to find the volume of rock A. [2]

(ii) Explain why the volume of rock D cannot be found with an ordinary laboratory measuring cylinder. [1]

(b) Calculate the density of rock A. [2]

(c) Three of the rocks are made from the same material.
State and explain which of the rocks is made from a different material. [2]

[N07/P2/Q2]

Solution

(a) (i) Some water is taken in the measuring cylinder and its reading is noted down. Let it be V_1. The rock is tied with cotton and lowered into water in the cylinder. The reading of the new level of water is noted down. Let it be V_2. The volume of the rock is then $= V_2 - V_1$.

(ii) The volume of the rock D is too large to be measured with an ordinary laboratory measuring cylinder. It will not fit in an ordinary laboratory measuring cylinder

(b) $\text{density} = \dfrac{\text{mass}}{\text{volume}} = \dfrac{101}{22} = 4.6 \text{ g/cm}^3$

(c) The rock C is made from a different material because the density of the material of rock C is different from the density of the material of other rocks.

Question 2

A space research organisation plans to send astronauts to Mars to examine rocks on its surface.

The organisation will produce a report containing information about conditions on Mars.

(a) (i) The gravitational field strength on the surface of Mars is 3.7 N / kg. Calculate the weight, on Mars, of a rock of mass 0.50 kg. [2]

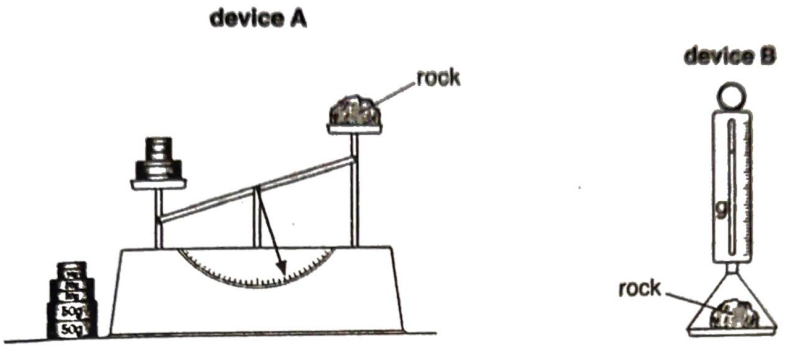
(ii) A rock dropped on Mars falls to the surface. State the acceleration of the falling rock.

Assume that there is no air resistance on Mars. **[1]**

(iii) Calculate the kinetic energy of a 0.50 kg rock as it strikes the surface at a speed of 3.2 m/s. **[3]**

(b) While still on the surface of Mars, the astronauts will measure the mass of each rock collected.

Fig. 10.1 shows two devices for measuring mass.



A lever arm balance and a set of brass discs. The mass of each disc is accurately determined on Earth and the value is marked on it.

A spring balance. The spring balance is accurately calibrated on Earth and the mass values are marked on the vertical scale.

Fig. 10.1

(i) When the two devices are used on Mars, they will give different readings for the mass of the same rock. Explain why. [3]

(ii) State which device will give the correct reading for the mass. [1]

(c) The astronauts will also determine the density of each rock.

(i) Apart from the mass of the rock, state what other information is needed in order to calculate the density of the rock. [1]

(ii) Describe a method for determining the density of a small, irregularly shaped rock of known mass m. [4]

[N09/P2/Q10]

Solution

(a) (i) $W = mg = 0.50 \times 3.7 = 1.85$ N

(ii) 3.7 ms^{-2}

(iii) K.E. $= \frac{1}{2} mv^2 = \frac{1}{2} \times 0.50 \times (3.2)^2 = 2.56$ J

(b) (i) The lever arm balance (device A) compares the mass of a body with the standard masses and it is independent of the gravitational field strength (i.e. the value of g). So, it gives the same value of the mass of a body whether measured on the Earth or on the Mars. Whereas the spring balance (device B) is dependent on the force of gravity and as this device is calibrated on the earth, it will give a different value of the mass of the same body on the Mars where the gravitational field strength is smaller than the earth.

(ii) device A.

(c) (i) Volume of the rock.

(ii) Take some water in a measuring cylinder and note down its volume as V_1. Tie the rock with a thread and lower it into the water gently until it is completely submerged in the water. Note down the new reading of the volume as V_2.

The volume of the rock is then found as:

Volume of rock (V) = $V_2 - V_1$

The density of the rock is then calculated as follows:

$$\text{density}(\rho) = \frac{\text{mass of rock } (m)}{\text{volume of rock (V)}}$$

Question 3

A student wishes to find the density of a stone. He uses a measuring cylinder and a spring balance with a scale marked in newtons. The measuring cylinder, spring balance and stone are shown in Fig. 1.1.

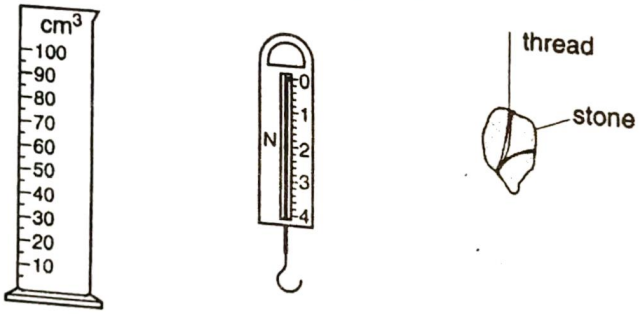


Fig. 1.1

The student knows that the gravitational field strength is 10 N/kg.

(a) Describe how the student uses the spring balance to find the mass of the stone. [2]

(b) Describe how the student uses the measuring cylinder to find the volume of the stone. [2]

(c) The mass of the stone is 150 g and its volume is 70 cm^3.
Calculate the density of the stone. [1]

(d) The stone is taken to another place, where the gravitational field strength is less than 10 N/kg. State how this affects the mass and the weight of the stone. [1]

[J11/P2/Q1]

Solution

(a) He uses the spring balance and measures the weight of the stone. He then applies the equation $W = mg$ to find the value of the mass of the stone.

(b) Some water is taken in the measuring cylinder and its volume is noted down as V_1. The stone is then immersed fully in water and the new reading of the volume is noted down as V_2. Then, volume of stone = $V_2 - V_1$.

(c) Density of stone = $\frac{\text{mass}}{\text{volume}} = \frac{150}{70} = 2.14$ g/cm^3

(d) mass: unchanged
weight: less

Question 4

Fig. 2.1 shows a boy moving a water container in a wheelbarrow.

Fig. 2.1

The container has a volume of 0.15 m^3 and is filled with water of density 1000 kg / m^3.

(a) Calculate the mass of water in the container when it is full. [2]

(b) It is harder to stop the wheelbarrow when the container is full than when it is empty. Explain this. [2]

[N13/P2/Q2]

Solution

(a) Mass = density × volume

$= 1000 \times 0.15 = 150\,kg$

(b) The container has a greater mass when it is full; so it has a greater inertia and hence it provides more resistance to a change in its state of motion.

m d inertia