SANSKAR SCHOOL

REVISION NOTES (PHYSICS) -1

CLASS 9 IGCSE

P1 Making Measurements

SI System of units

Base quantities and their units in SI: -

Quantity	SI unit	Symbol	Device
LENGTH	meter	m	Meter Rule
MASS	kilogram	kg	Balance
TIME	second	sec	Stopwatch

Some common prefixes: -

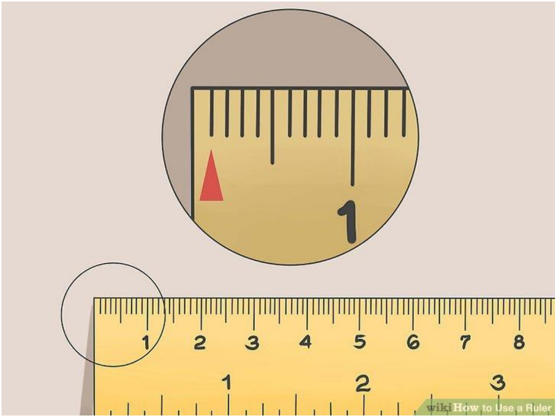
Prefix	Symbol	Multiplying Factor
micro	µ	10^{-6}
milli	m	10^{-3}
centi	c	10^{-2}
kilo	k	10^{3}
mega	M	10^{6}

Measuring Length

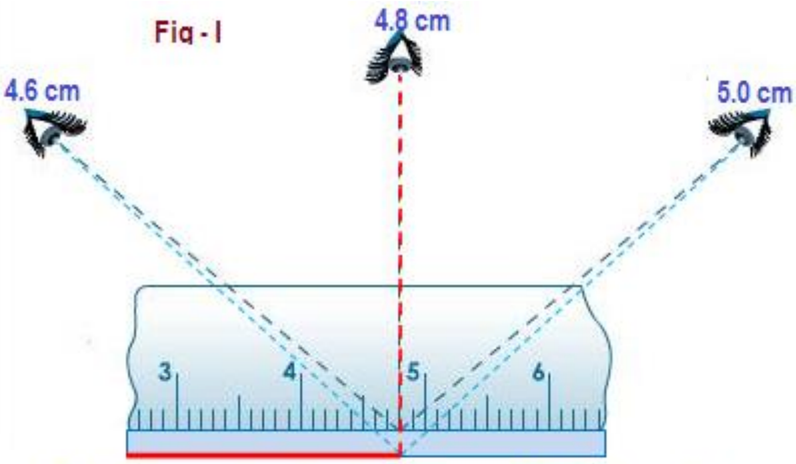
1. Length is the distance between two points in space.
2. There are several kinds of measuring devices used to measure length, among others, are as follows.

    I. Measuring tape

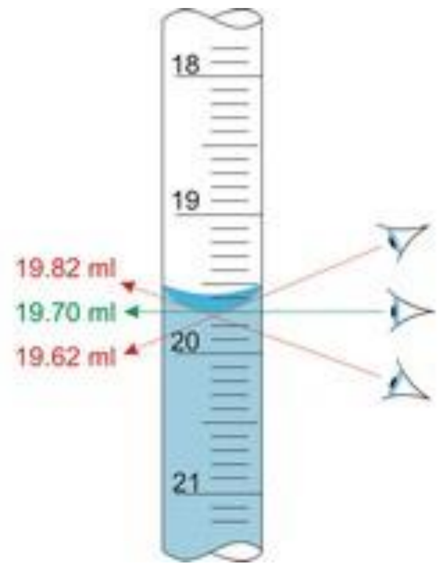
    II. Rule



3. We use a meter rule for measuring ordinary lengths. We lay the rule closely alongside the length to be measured such that one end of the given length meets the zero end of the rule and we take the reading of rule at the other end of the given length.
4. To obtain the average value of a small length or distance, multiples can be measured e.g. to find the thickness of a sheet of paper we take a pile of many sheets, find its thickness and then divide it by no of sheets taken.
5. Possible sources of errors in the measurement of length
   I. Error due to parallax: - Parallax error is an error caused by humans, while measuring a quantity if your eye is not at the proper angle to the scale you're reading, it will cause parallax error. It only depends upon the line of sight. Parallax error can be easily removed by careful observation.



Parallax error arises due to thickness of the ruler used



II. Zero error: - Sometimes the zero end of a ruler may be broken. In such a situation you can use any other full mark of the scale, say, 1.0 cm. Then subtract 1 cm from the reading to get the correct reading.

III. Wrong placement of the scale: - The ruler should be exactly parallel to the length to be measured.

IV. Length to be measured in not straight.

Rounding off

1. If the digit to be dropped is less than 5, the preceding digit is left unchanged. E.g. 17.43 → 17.4
2. If the digit to be dropped is more than 5, the preceding digit is raised by 1.E.g. 19.47→19.5
3. If the digit to be dropped is 5 followed by digits other than zero, the preceding digit is raised by 1. E.g. 16.352→16.4, 16.35279→16.4
4. If the digit to be dropped is 5 or 5 followed by zero, the preceding digit is left unchanged, if it is even and is raised by one, if it is odd. E.g. 12.45→ 12.4, 13.35→13.4, 19.750→19.8, 17.650→17.6

Scientific Notation

1. In scientific notation, a number is expressed in the power of 10 as $a \times 10^b$, where 'a' is the number between 1 and 10 and b is any positive or negative exponent of 10. The decimal point is written after the first non-zero digit.
2. We retain only those zeros in the base number which are the result of a measurement. Now the power of 10 is not relevant to the determination of significant numbers.

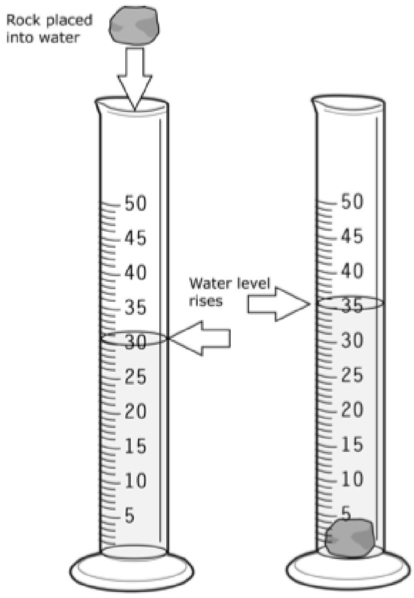
Measuring Area

3. We can use the following formulae to find the area of some regular shaped objects.
   $Area\ of\ square\ = (Side)^2$
   $Area\ of\ rectange = Length\ \times Breath$

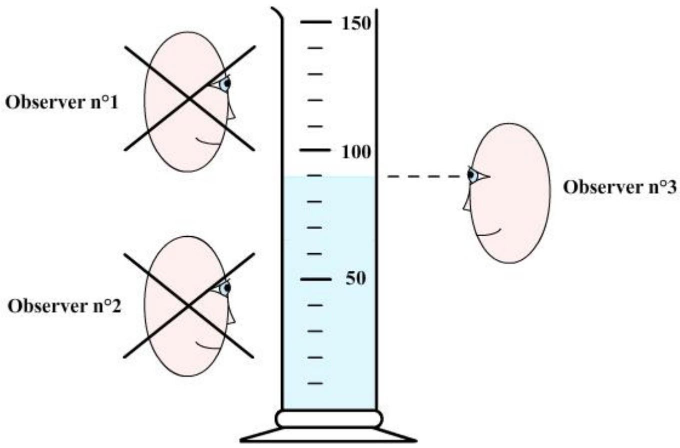
$$Area\ of\ triangle = \frac{1}{2} \times Base \times Height$$
$$Area\ of\ a\ circle\ = \pi r^2$$

Measuring Volume

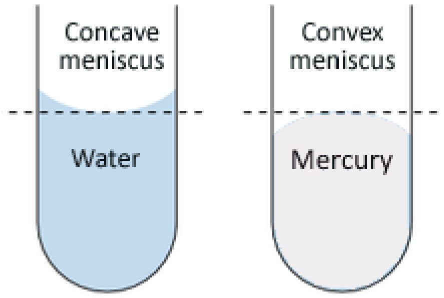
1. Volume is the amount of space occupied.
2. The SI unit of volume is m^3. The other units are;
   $1\ litre = 1000\ cm^3\ or\ 1000\ cc = \frac{1}{1000} m^3$
   $1ml = 1cm^3$
3. To measure the volume of a liquid we use a measuring cylinder. We take the given liquid in the measuring cylinder and take the reading.
4. Measuring the volume of a regular solid object: - To find out the volume of a regular object, you can use a mathematical formula, you just need to make a couple of length measurements.
   E.g. $Volume\ of\ a\ cube = (Side)^3$
   $Volume\ of\ a\ cuboid\ = lbh$
   $Volume\ of\ a\ cylinder\ = \pi r^2 h$
   $Volume\ of\ a\ sphere\ = \frac{4}{3}\pi r^3$
5. Measuring volume of a solid of irregular shape by displacement method: - To measure the volume of a solid object of irregular shape, we put the object into measuring cylinder with water. When we add the object it displaces the water, making the water level rise. Measure this rise. This is the volume of our object.



6. Precautions in taking readings: -
   a) The measuring cylinder should be upright or erect for that the cylinder should be kept on a flat horizontal surface.
   b) The line of sight must be perpendicular to the measuring scale to avoid parallax error.



c) Formation of bubbles inside the cylinder should be completely avoided. Any bubble within leads to wrong measurements.
d) Cylinder should be free of impurities or else they add up to ingredients inside and lead to wrong measurement.
e) One should always read the bottom of the meniscus (curved shape of the free surface of the liquid). The meniscus formed by the mercury is curved (convex) opposite to that of other liquids (concave) and the top is read.



f) One should prefer a measuring cylinder of smaller diameter (lesser LC).

Measurement of mass

1. The amount of matter contained in an object is called its mass.
2. The SI unit is kg and the other unit is gram (g).
   $1\ kg = 1000\ g$ and $1g = \frac{1}{1000} kg = 0.001\ kg$
3. The mass can be measured with beam balance, lever balance or electronic balance etc.

Density

1. It is defined as mass per unit volume.
   $\rho = \frac{m}{V}$
2. The symbol for density is rho (ρ).
3. SI unit is kg/m^3.
4. Gases have much lower density than liquids or solids.
5. Density is the key to floating, ice is less dense than water.
6. Density of water is $10^3 \frac{kg}{m^3}$ $or\ 1\ g/cm^3$.

Measuring time

1. Time: - It is the ordering or duration of events.
2. Any phenomenon that repeats itself after a regular interval of time can be used to measure time e.g. heart beats, swinging of a pendulum etc.

3. 1 Second: - The second is the duration of 9 192 631 770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium 133 atom.
4. Other units of time are minute, hour, day, week, month and year etc.
5. The common devices to measure the time or duration of an event are clock and stopwatch. In stopwatch, each second is calibrated into one hundred part of a second called cent second. The precession of time duration of an event can be improved by measuring the time for number of events and dividing time by total number of events. For example to measure the time period of a pendulum the time for ten swings should be recorded and dividing the total time by ten to get the time for one swing.
6. Taking time with a stop watch: -

Instrument	**Least count**
Clocks	1 s
Stop Watch	0.01 s
Ticker tape timer	0.02 s between 2 dots

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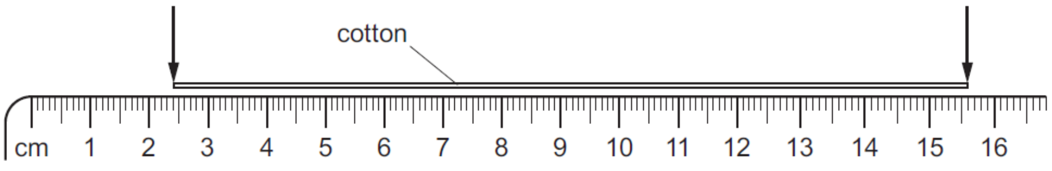
Video links:

https://www.youtube.com/watch?v=zhkijNafIUM [Please ignore the Vernier calliper and screw gauge]

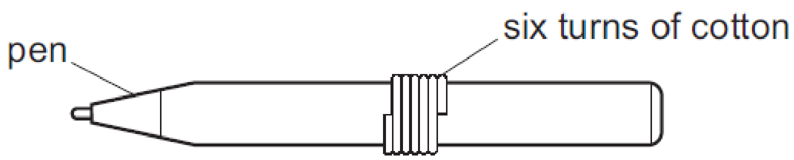
https://www.youtube.com/watch?v=T9G0orM9i48

Cambridge Assessment International Education	SANSKAR SCHOOL The Revival of Tradition	INTERNATIONAL SCHOOL AWARD 2016–2019
GRADE: 9	SUBJECT: PHYSICS (0653)	DATE: 31.03.2020
WORKSHEET NUMBER: 1	WORKSHEET TOPIC: P1 : MAKING MEASUREMENT	
INSTRUCTION (IF ANY):	Read the notes before solving the worksheet, Write you name in the solution sheet.	

Q.1. A length of cotton is measured between two points on a ruler.



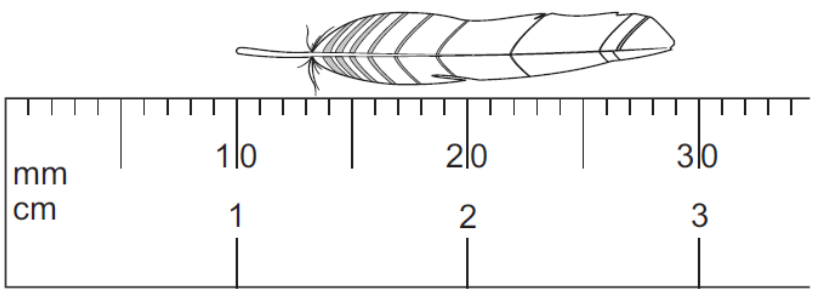
When the length of cotton is wound closely around a pen, it goes round six times.



What is the distance once round the pen?

(A) 2.2 cm (B) 2.6 cm (C) 13.2 cm (D) 15.6 cm [ ]

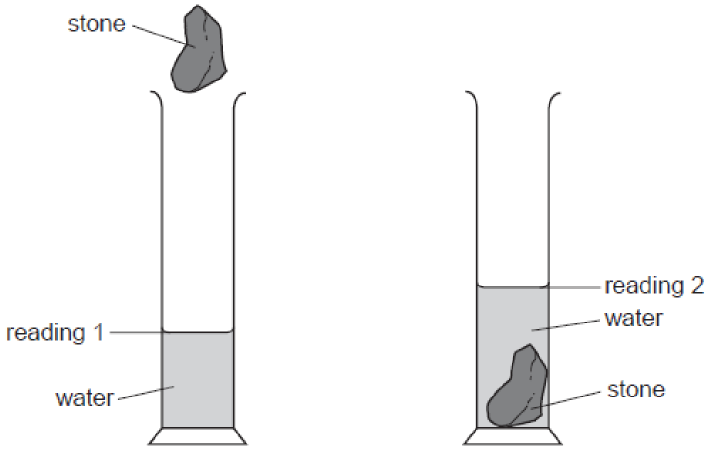
Q.2. The diagram shows an enlarged drawing of the end of a metre rule. It is being used to measure the length of a small feather.



What is the length of the feather?

(A) 19 mm (B) 29 mm (C) 19 cm (D) 29 cm [ ]

Q.3. A student wishes to determine the density of an irregularly-shaped stone. First he finds the mass of the stone. Next he lowers the stone into a measuring cylinder containing water. The diagrams show the measuring cylinder before and after the stone is lowered into it.



How should the student calculate the density of the stone?

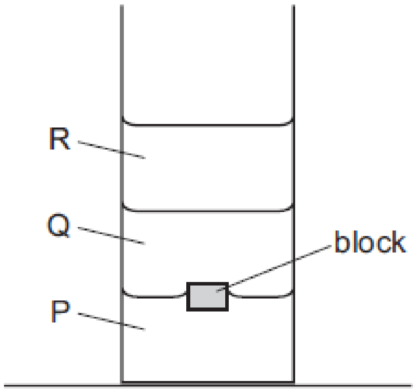
(A) mass of stone × reading 2

(B) mass of stone × (reading 2 – reading 1)

(C) mass of stone ÷ reading 2

(D) mass of stone ÷ (reading 2 – reading 1) [ ]

Q.4. Three liquids P, Q and R have different densities and do not mix. The liquids are placed in a measuring cylinder and allowed to settle. A small block is then dropped into the measuring cylinder and comes to rest, as shown.



Which statement about the density of the block is correct?

(A) It is equal to the density of Q.

(B) It is greater than the density of P.

(C) It is greater than the density of R.

(D) It is less than the density of Q.

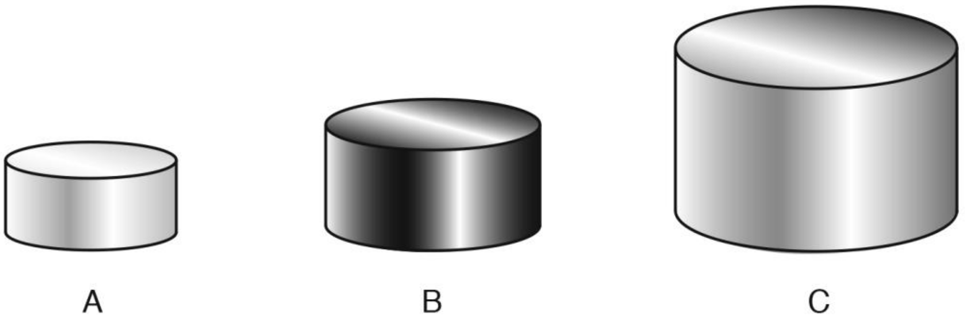
Q.5. Two objects P and Q are placed in a beaker containing a liquid.
Object P floats in the liquid and object Q sinks.

Which row for the densities of object P, object Q and the liquid is possible?

	density of object P g/cm³	density of object Q g/cm³	density of liquid g/cm³
A	1.2	0.6	0.8
B	1.2	1.4	1.0
C	11.3	8.9	13.6
D	11.3	19.3	13.6

[ ]

Q.6. The diagram shows three metal blocks. Each block has the same mass.



The volumes of the blocks are different.
Each block is made of a different metal. The table gives the density of each

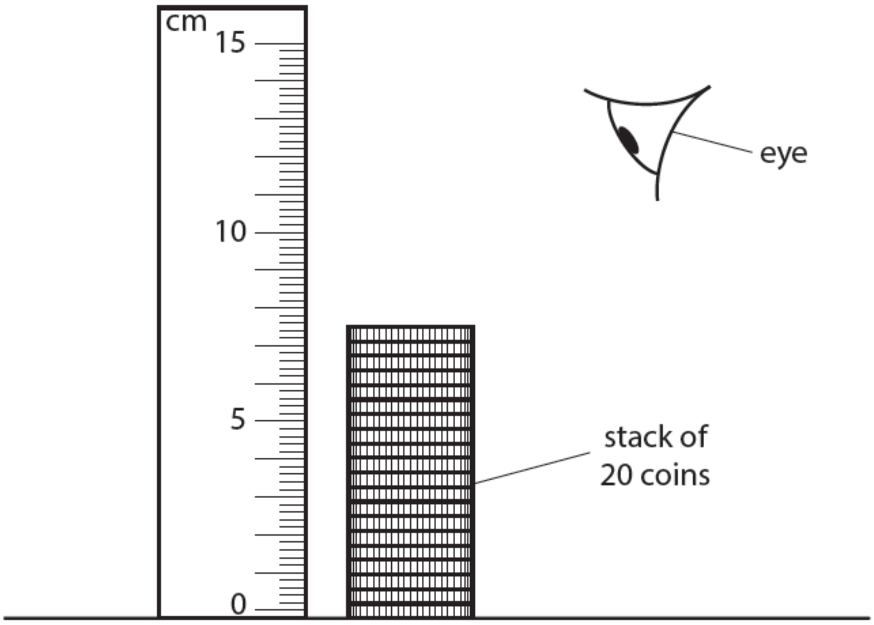
name of metal	density (g/cm^3)
aluminium	2.83
iron	6.95
lead	11.3

metal.

Use the data from the table to identify the metal used to make each block.
A ....
B ....
C .... [1]

Q.7. A student has a stack of 20 identical coins.

The figure shows the student measuring the height of the stack using a ruler.



With his eye at the position shown, the student's measurement of the height of the stack is 6.8 cm.

Suggest two reasons why the student's measurement is inaccurate.

1...

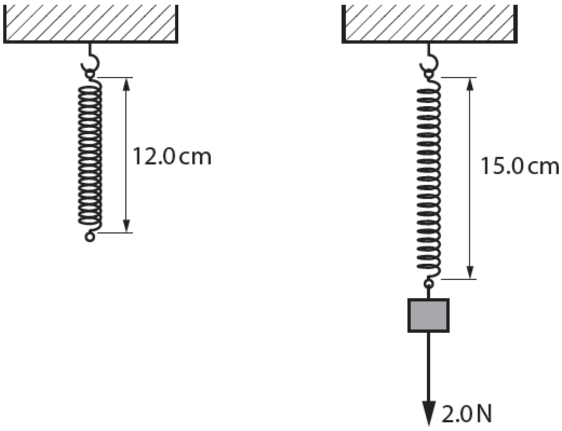
....

2...

....

[Total: 2]

Q.8. A student hangs a spring vertically from a hook, as shown in the figure.



Describe how the length of the spring can be measured accurately, after it has been hung from the hook.

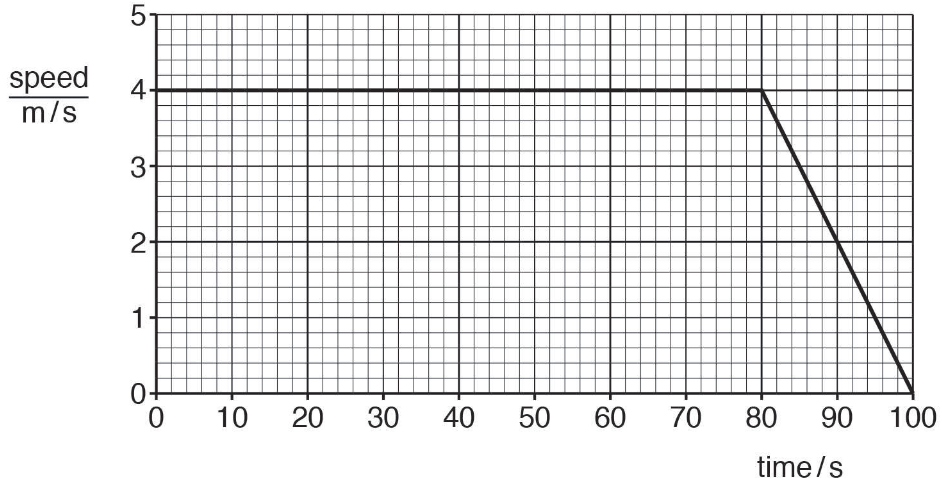
....

....

....

.... [3]

1 The diagram shows a speed-time graph for a student who is running.



Describe the movement of the student, as shown in the speed-time graph.

....

....

.... [2]

[Total: 2]

2 The diagram shows students getting onto a school bus.

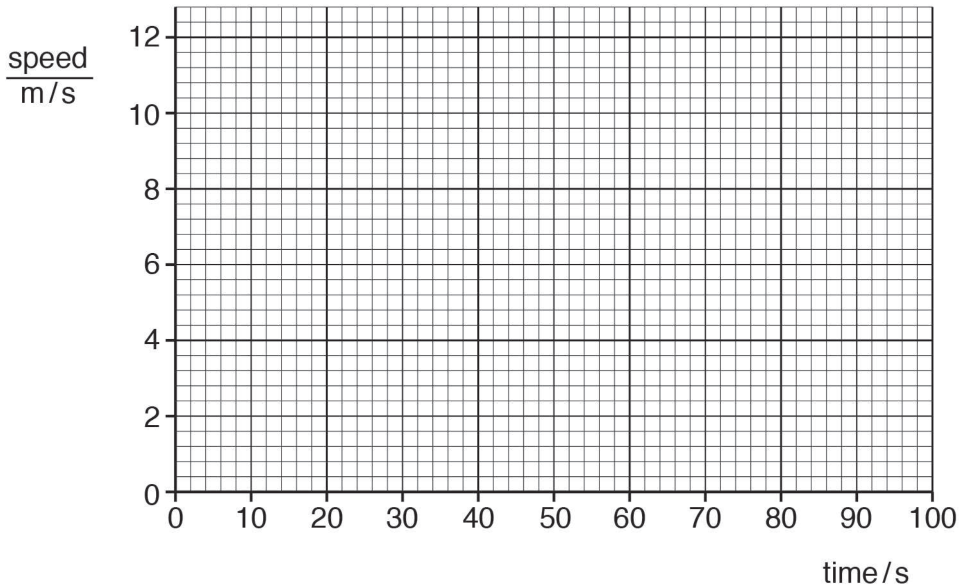
A student describes part of the journey.

The bus accelerates from rest at a constant rate for 10 s. It reaches a maximum speed of 10 m / s.

The bus maintains a constant speed of 10 m / s for 60 s.

The bus then decelerates at a constant rate for 15 s, until it stops.

On the grid, draw the speed-time graph for this part of the journey made by the bus.



[5]

[Total: 5]

3 An athlete runs 630 m in 130 s on a flat section of a road and then 254 m in 40 s on a downhill slope.

Calculate the average speed for the total distance run by the athlete.

average speed = ... m / s [3]

[Total: 3]

4 A car is travelling at a constant speed.

The path of the car is part of a circle.

For this motion, state:

1. the direction of the resultant force on the car, ...

....

2. what happens to the velocity of the car. ....

.... [2]

[Total: 2]

Cambridge Assessment International Education	SANSKAR SCHOOL The Revival of Tradition	INTERNATIONAL SCHOOL AWARD 2016-2019
GRADE: **9**	SUBJECT: PHYSICS (0653)	DATE: 07.04.2020
WORKSHEET NUMBER: **2**	WORKSHEET TOPIC: P1 : MAKING MEASUREMENT	
INSTRUCTION (IF ANY):	Read the notes before solving the worksheet, Write you name in the solution sheet.	

Refer the revision notes of topic P1 and also watch the following videos.

https://www.youtube.com/watch?v=TwCW98Vmse4

https://www.youtube.com/watch?v=QXoQbWoIiRE

https://www.youtube.com/watch?v=CAFGiI8708M

https://www.youtube.com/watch?v=s5u5cmA9Dp0

https://www.youtube.com/watch?v=ovdE_-FCWpc

https://www.youtube.com/watch?v=T9G0orM9i48

https://www.youtube.com/watch?v=02w9lSii_Hs

https://www.youtube.com/watch?v=zhkijNafIUM

https://www.youtube.com/watch?v=hAISTpfStFE

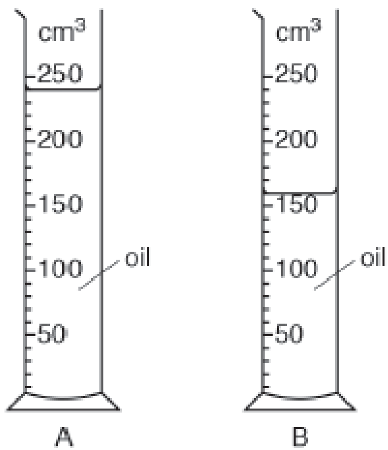
1 A bottle contains some oil.

(a) The mass of the oil and the bottle is 678 g. The mass of the empty bottle is 318 g.

Calculate the mass of the oil.

mass = ... g [1]

(b) Some of the oil from **(a)** is poured into measuring cylinder A. The rest of the oil is poured into measuring cylinder B, as shown in the diagram.



(i) State the volume of oil in measuring cylinder B, as shown in the diagram.

volume = ... cm^3 [1]

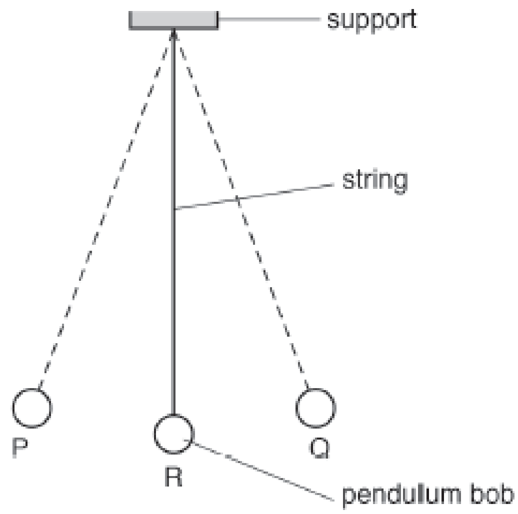
(ii) Calculate the total volume of oil.

(iii) Calculate the density of the oil.

density = ... g/cm^3 [3]

[Total: 6]

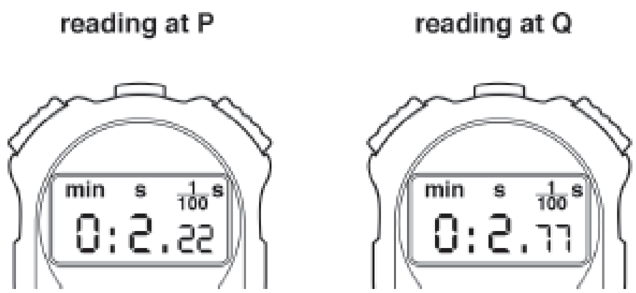
2 The diagram shows a simple pendulum swinging backwards and forwards between P and Q. One complete oscillation of the pendulum is when the bob swings from P to Q and then back to P.



A student starts two stopwatches at the same time while the pendulum bob is swinging.

The student stops one stopwatch when the pendulum bob is at P. He stops the other stopwatch when the pendulum bob next is at Q.

The diagram shows the readings on the stopwatches.



(a) Use the readings on the two stopwatches to determine the time for one complete oscillation of the pendulum.

time = ... s [2]

(b) The method used by the student does not give an accurate value for one complete oscillation of the pendulum.

Describe how the student could obtain an accurate value for one complete oscillation of the pendulum.

....

....

....

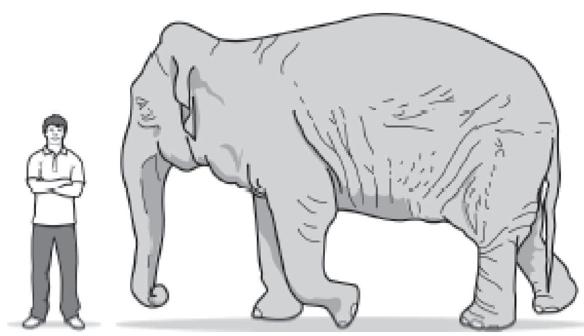
....

....

.... [4]

[Total: 6]

3 A student is studying elephants.The diagram shows an elephant.



(a) The student measures the elephant and records the values, as shown in the table.

Complete the table by adding a suitable unit for each measurement. Choose the units from those shown in the box.

m^2	kg	cm	mm^2	g	m	cm^2	mg	mm

measurements	value	unit
mass of elephant	4000	
height of elephant	3.0	
average area of an elephant's foot	0.125	

[2]

(b) Using information from the table in **(a)**:

(i) calculate the weight of the elephant

weight = ... N [3]

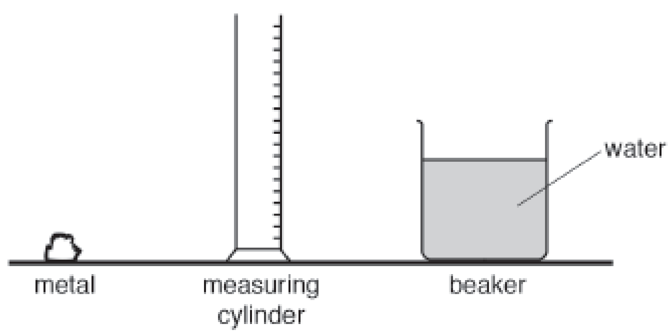
(ii) calculate the pressure the elephant exerts on the ground when it is standing on four feet. Include a unit.

pressure = ... [4]

[Total: 9]

4 The diagram shows a piece of metal, a measuring cylinder and a beaker containing water.

The metal has an irregular shape and weight of 3.0 N.



(a) Describe how to determine the volume of the metal, using the equipment in the diagram.

....

....

....

....

....

.... [4]

(b) Explain why the procedure in **(a)** is not suitable for finding the volume of a piece of low-density wood that is of similar shape and size to the piece of metal in **(a)**.

....

.... [1]

[Total: 5]

5 A student wishes to determine the density of a small, irregularly shaped stone.

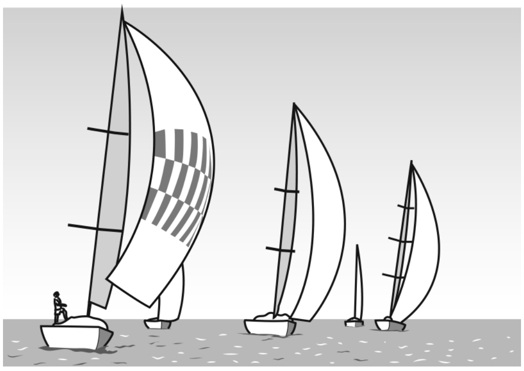
State the formula that is used to calculate the density.

....

.... [1]

[Total: 1]

1 A boat race starts on the sea, but close to land. The diagram shows the boats at the start of the race.



On the land, a cannon produces a loud bang to start the race. There is a flash of light at the same time as the bang.

(a) One of the sailors is 500 m from the cannon. She measures a time difference of 1.6 seconds between seeing the flash of light and hearing the bang.

Calculate the speed of sound.

speed of sound = ... m / s [3]

(b) The value of the speed of sound obtained in **(a)** is lower than expected.

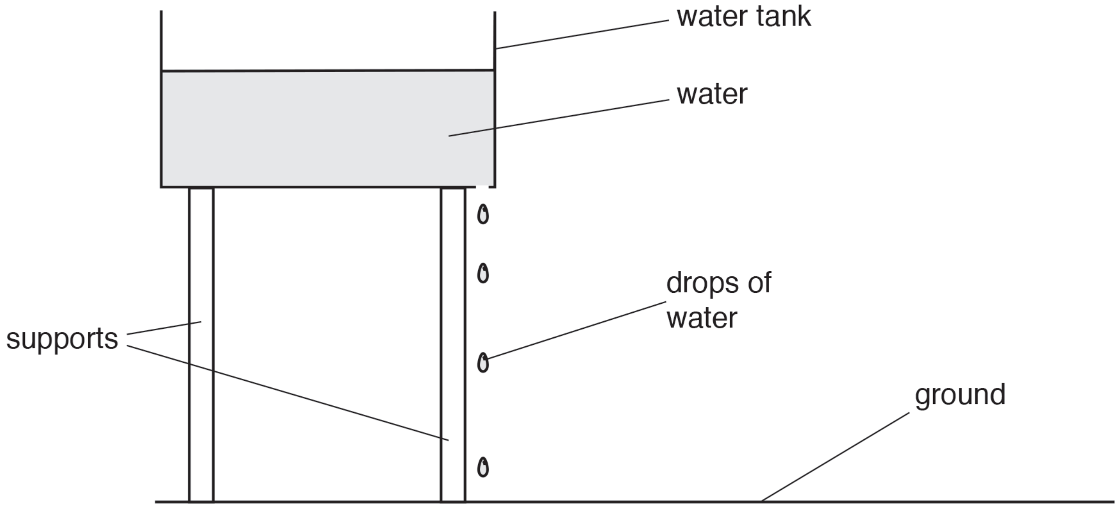
Suggest a reason for this difference.

....

.... [1]

[Total: 4]

2 The diagram shows a water tank that is leaking. Drops of water fall from the tank at a constant rate.



The diagram shows that the drops get further apart as they get close to the ground.

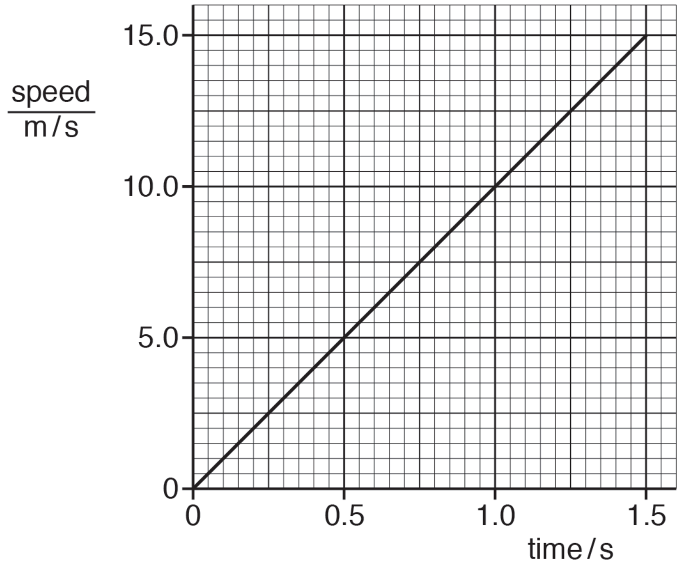
State why the drops get further apart.

....

.... [1]

[Total: 1]

3 In an experiment a student determines the speed of a falling weight at different times. The graph is a speed–time graph for his results.



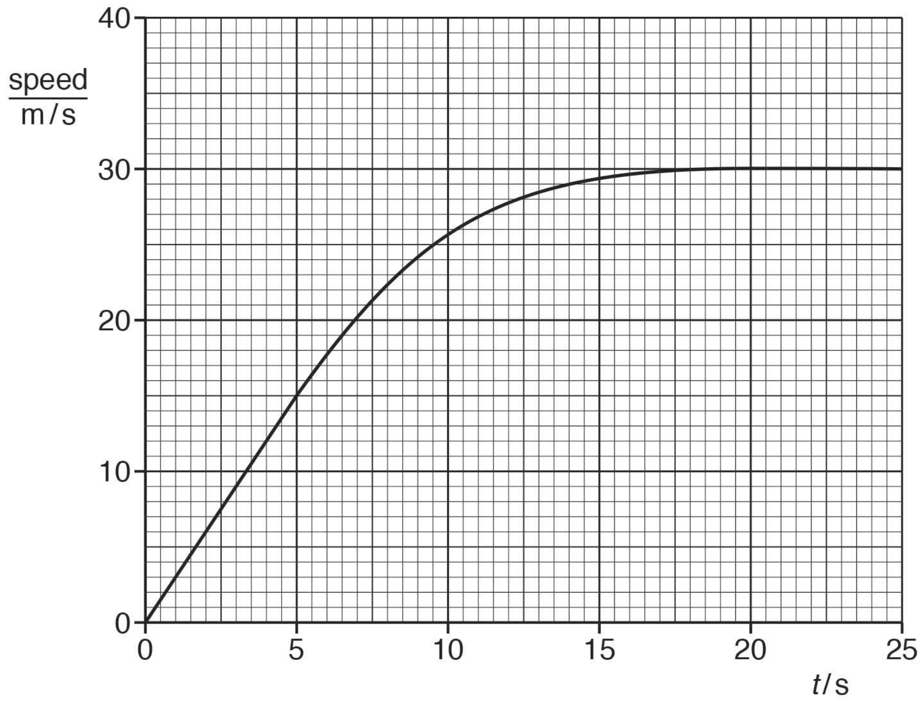
Calculate the distance fallen by the weight in the first 1.5 s.

distance = ... m [3]

[Total: 3]

4 A car accelerates from rest at time $t = 0$ to its maximum speed.

The graph is the speed-time graph for the first 25 s of its motion.



Describe the motion of the car between $t = 10$ s and $t = 15$ s. Explain how the graph shows this.

....

....

....

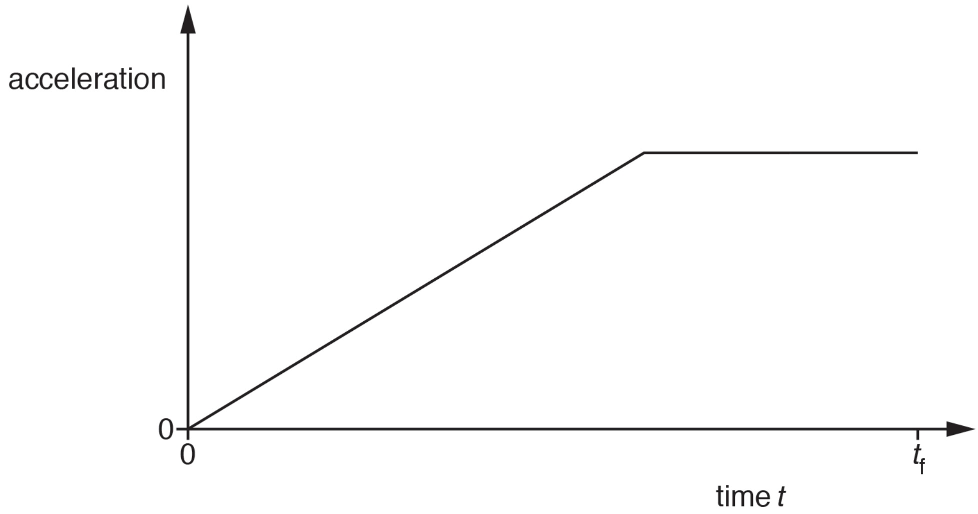
.... [3]

[Total: 3]

5 A rocket is stationary on the launchpad. At time $t = 0$, the rocket engines are switched on and exhaust gases are ejected from the nozzles of the engines. The rocket accelerates upwards.

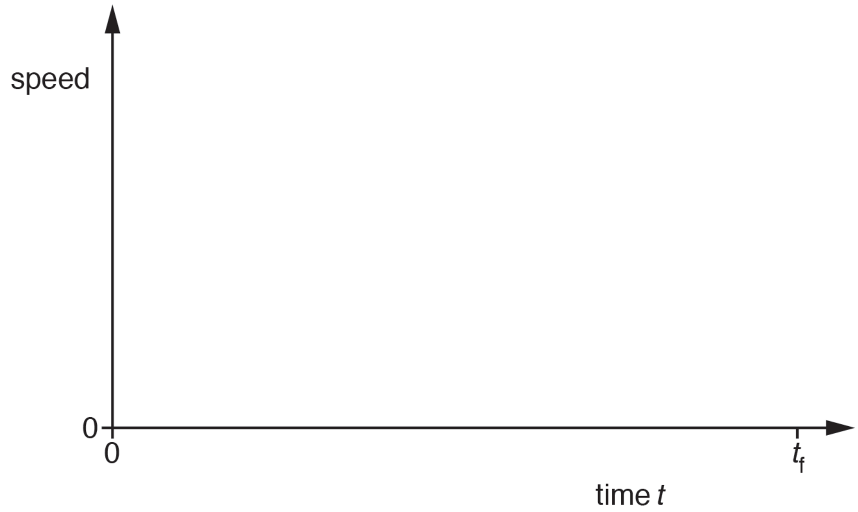
Diagram A shows how the acceleration of the rocket varies between time $t = 0$ and time $t = t_f$.

Diagram A



On diagram B, sketch a graph to show how the speed of the rocket varies between time $t = 0$ and time $t = t_f$.

Diagram B



[3]

[Total: 3]

TOPIC P 11 THERMAL ENERGY TRANSFERS

Convection

1. It is the main method of heat transfer through fluids.
2. In convection, thermal energy is transferred through a material from a hotter place to a cooler place by the actual movement of the particles of material itself.
3. Explaining convection: - When a liquid is heated, it expands and density decreases. Due to this the hot liquid rises and the cold one goes below to replace it this way the entire liquid gets heated.
4. There are two types of convection viz., (a) natural and (b) forced convection.
5. *Natural convection* is due to buoyancy forces that results from the density variations due to variations of temperature in the fluid. Natural convection is always from bottom to top. Example is ventilation. The hot air in the room rises and goes out through ventilators and fresh cool air comes inside from the window.
6. *Forced convection*: - When a fluid is pumped by a motor to create convection currents then it is called forced convection. Example pumping of blood by heart in arteries. Forced convection can be in any direction.
7. Cold objects also produce convection currents e.g. water sinking below an ice cube in a drink. In a refrigerator, the freezing surface is usually positioned at the top and the back, so that cold air will sink to the bottom and warm air rises to be re-chilled.

https://www.youtube.com/watch?v=VxGIiOTuAIs

Q.1.

a) Name a good conductor of heat

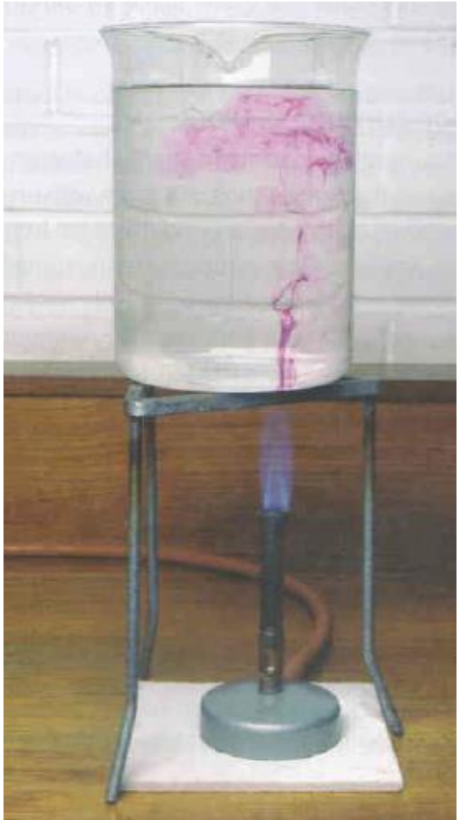
b) Name a good thermal insulator

Q.2. What is needed for heat to flow through a conductor?

Q.3. Look at table P11.01. Which will feel colder to the touch, marble or polystyrene.

Demonstrating convection

1. Take a beaker with a drop of some dye into it now pour some water and heat the beaker on a stove. We see the color of dye moving upwards, this shows convection currents. The water at the bottom gets heated and becomes lighter due to expansion and floats upwards and colder liquid being heavier comes to replace it. This way the entire water gets heated.



Q.4. ‘A thermal energy transfer by means of the motion of a fluid’ Is this the description of conduction or convection?

Q.5. When a gas is heated, its particles gain energy. Imagine that you could see the particles of a hot gas and of a cold gas (at the same pressure).

a) What difference would you see in their movement?

b) What difference would you see in their separation?

Q.6. What part does convection play in the spreading of energy around a room from an electric heater?

Q.7. Why would it not be a good idea to fit an electric heater near the ceiling in a room?

Q.8. Write a brief explanation of convection, using the terms expansion, density and gravity.

Radiation

1. In this method, heat is transferred in the form of EM waves without requiring any material medium. It does not affect the medium through which it passes.
2. It is the fastest mode heat transfer.
3. Solid and liquid surfaces radiates at all temperature. These surfaces also have the capacity to absorb radiations.
4. Thermal radiation ranges in wavelength from the longest infrared rays through the visible-light spectrum to the shortest ultraviolet rays. Most of the heat radiations are into infrared region.
   Radio wave, Micro, IR, Visible (R-V), UV, X, Gamma
5. The intensity and distribution of radiant energy within this range is governed by the temperature of the emitting surface.
6. *The total radiant heat energy emitted by a surface is proportional to the fourth power of its absolute temperature (the Stefan–Boltzmann law).*
7. The rate at which a body radiates (or absorbs) thermal radiation depends upon the temperature and nature of the surface.
8. Objects that are good emitters are also good absorbers (Kirchhoff's radiation law).
9. Some properties of infrared radiations: -
   a) It is produced by warm or hot objects.
   b) It is a form of EM radiations.
   c) It travels in straight line.
   d) It warms the object that absorbs it.
   e) It is invisible to the naked eyes.
   f) It can be detected by nerve cells in the skin.

https://www.youtube.com/watch?v=5GoZZKcNZiQ

a) the house, so that less escapes from the house.

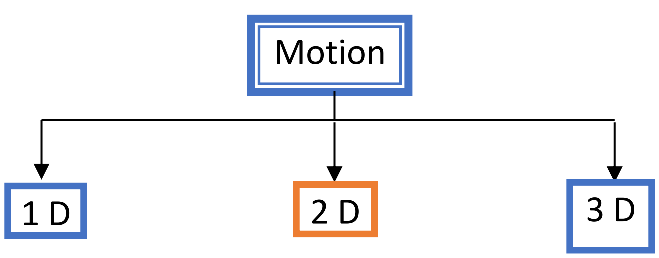
P2: Describing Motion

Motion

1. If the position of a body changes continuously with time w.r.t an observer, the body is said to be moving otherwise at rest.
2. It is always relative e.g. to the passengers in a moving bus trees, buildings and people on the roadsides appear to be moving backwards but the same things are stationary for the person standing on the ground outside the bus. Thus motion or rest is always relative. No absolute motion is possible.
3. All motions are studied under two branches of physics;
   a) Kinematics: - It deals with effects of motion and uses position, velocity and acceleration as three variables to describe any motion.
   b) Dynamics: - It deals with the causes of motion such as force and torque.

Classification of motion

1. There are two branches of physics viz., kinematics and dynamics to a study any motion.
2. Kinematics deals with the effects of motion and describes any motion with the help of variables of motion (position, speed and acceleration).
3. Dynamics deals with the causes of motion i.e. forces and torques.
4. Motions have been classified into three types as follows;



a) Motion on a straight lie path or 1 dimensional motion. E.g. A car moving on a straight road.
b) Motion in a plane. An insect moving on a plane surface.
c) Motion in space. E.g. Birds flying anywhere in the sky.

Distance / Displacement

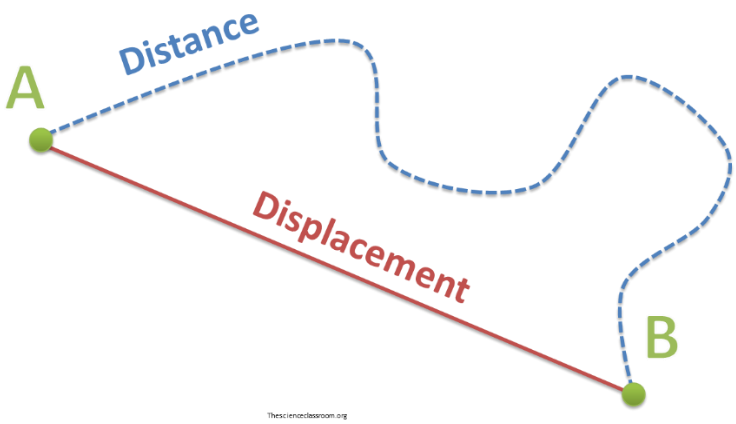


Figure 1Demo of distance and displacement

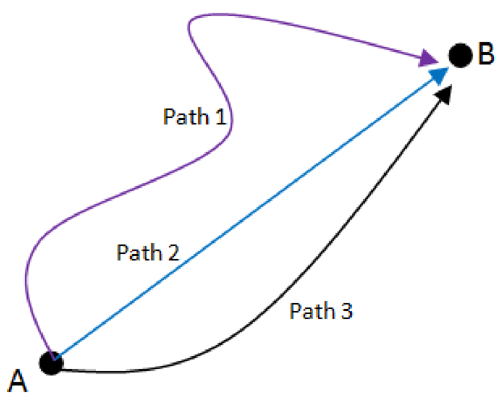


Figure 2Distance is multivalued while displacement is single value

Distance	Displacement
1) It is the length of actual path covered by an object between the initial and the final position. (Fig:1)	1) It is the direct distance between initial and final position, directed from initial to final position.

2) Scalar	2) Vector
3) Distance $\geq$ the magnitude of displacement. (Fig:2)	3) Magnitude of displacement $\leq$ distance.
4) It can never be negative.	4) It can be positive, zero or negative.
5) It always increases with time.	5) It can decrease also with time.
6) It is multi valued. (Fig:2)	6) It is single valued.

Q.1. Find the distance and the displacement for the following paths.

Q___10m___O ___10m____P

a) $O \rightarrow P$
   $d = 10\ m\ and\ \vec{x} = +10\ m$
b) $O \rightarrow P \rightarrow O$
   $d = 20\ m\ and\ \vec{x} = 0\ m$
c) $O \rightarrow P \rightarrow O \rightarrow Q$
   $d = 30\ m\ and\ \vec{x} = -10\ m$

Speed

1. Average speed: - The distance covered per unit time is called average speed.

   I.e. $\bar{S} = \frac{d}{t}$
2. SI unit of speed is m/s. Other units are km/h and mph.
3. $\frac{km}{h} = \frac{18}{5}\frac{m}{s} \quad or \quad \frac{m}{s} = \frac{5}{18}\frac{km}{h}$
4. $\bar{S} = \frac{u+v}{2} = \frac{Initial\ speed + Final\ speed}{2}$
5. $Distance = \bar{S} \times t$
6. Instantaneous speed: - The speed at a particular instant of time is called instantaneous

Q.1. A train begins a journey from a station and travels 60 km in a time of 20 minutes.
What is the average speed of the train?
(A) 3.0 m / s (B) 5.0 m / s (C) 50 m / s (D) 60 m / s [C]

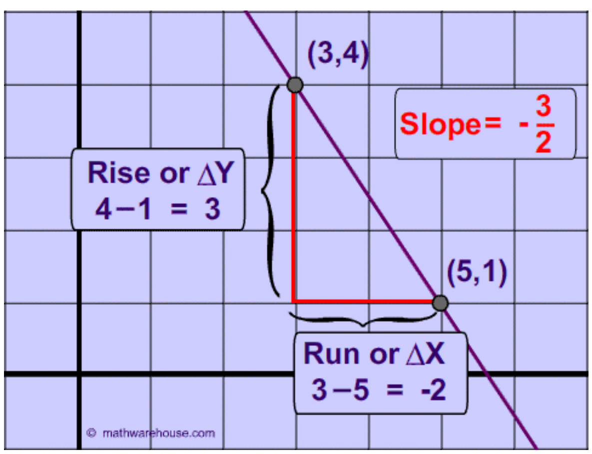
Calculation of slope of a line

1. Slope of line: -

$$m = \frac{Rise}{Run} = \frac{y_2 - y_1}{x_2 - x_1}$$

θ – is the angle made by the line with the x-axis (called inclination)

2. One can choose the co-ordinates of points A and B as $(x_2,\ y_2)\ and\ (x_1,\ y_1)$ too.
3. Greater the inclination of a line with horizontal axis, greater will be the slope.
4. If the line is sloping upwards, the slope will be positive and if it slopes downwards, slope will be negative. If it is parallel to horizontal axis, the slope will be zero.



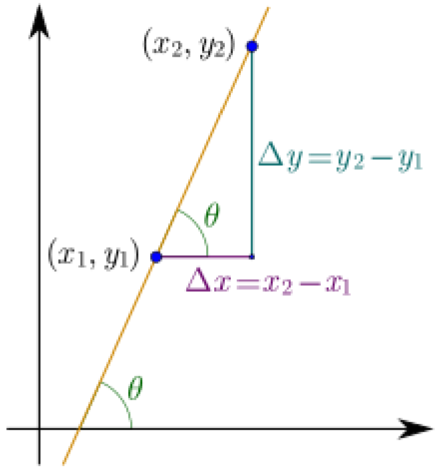
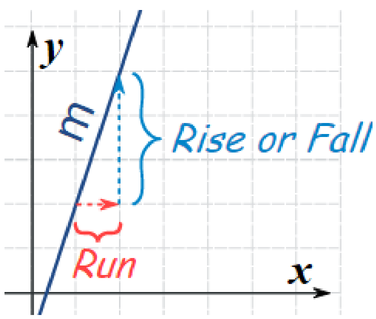
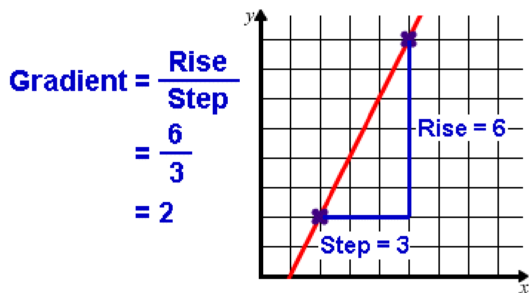
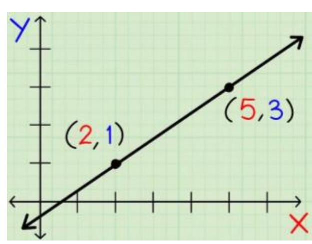


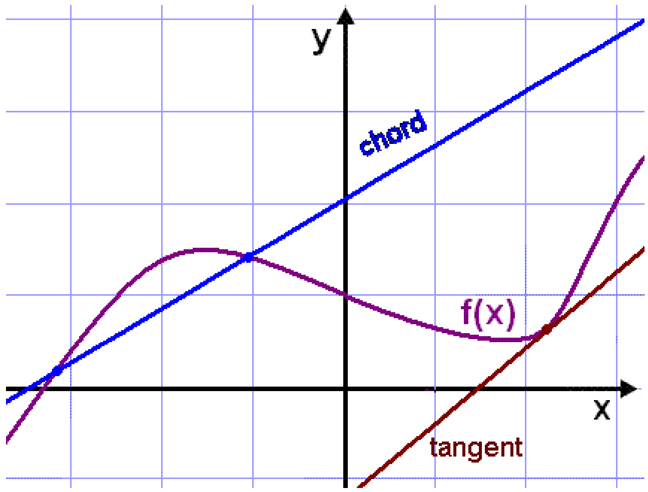
Figure 3 Slope of a line





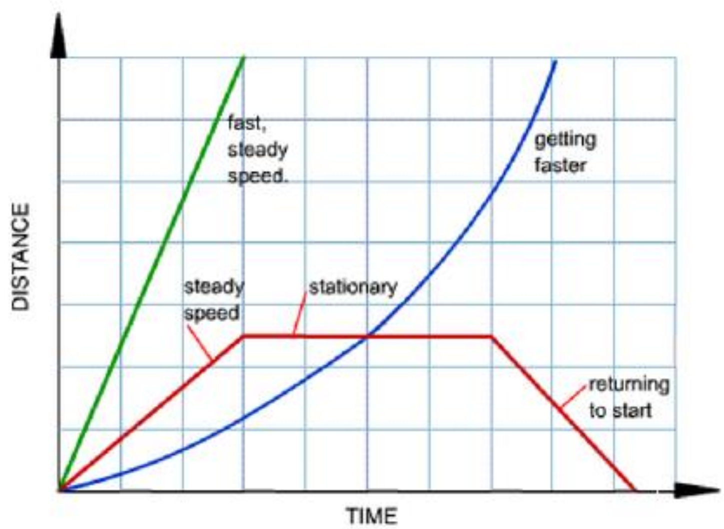


Slope of a curve



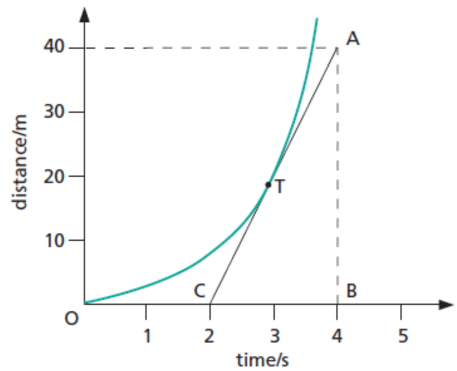
Distance-time graph

1. The distance -time graph can be used for;
   a) describing the motion of an object;
      i) If the distance / displacement time graph is a straight line parallel to time axis, the body is at rest.
      ii) If the distance / displacement time graph is a straight line inclined to the time axis, the motion is uniform (i.e. constant speed).
      iii) If the distance / displacement-time graph is a curve than the speed / velocity is not constant and the motion is non-uniform.



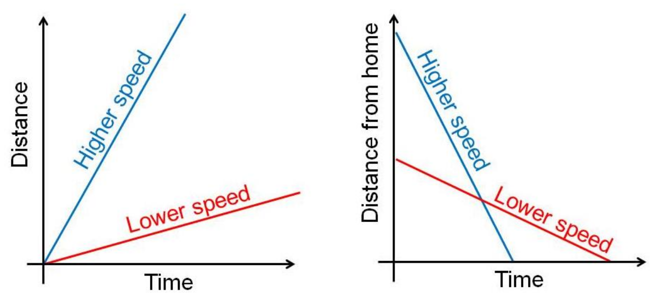
   b) calculating the distance traveled in a given time.
   c) calculating the speed.

i) The slope of tangent at a point on distance-time graph gives instantaneous speed at that point of time.



ii) The slope of chord drawn on a distance-time graph gives the average speed for the given interval of time.

iii) More slope more speed.

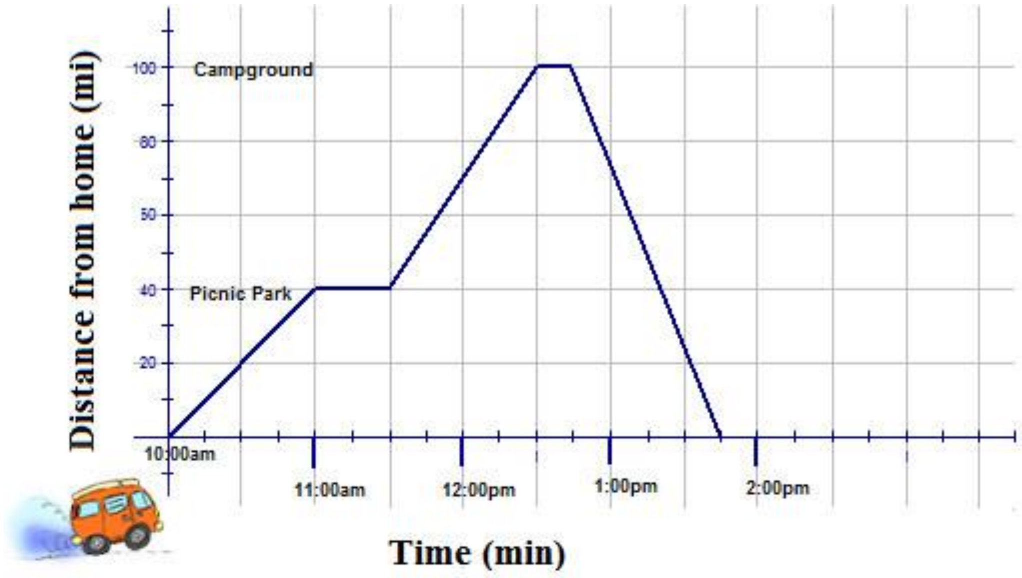


iv) Zero slope shows zero speed i.e. the body is at rest.

d) Plotting v-t graph.

Work sheet

Q.1. The following graph is an example of a broken-line graph, and it represents the time of a round-trip journey, driving from home to a popular campground and back.



a) How far is it from home to the picnic park? 40 mi

b) How far is it from the picnic park to the campground?

   It is 60 miles from the picnic park to the campground.

c) At what 2 places did the car stop?

   The car stopped at the picnic park and at the campground.

d) How long was the car stopped at the campground?

   The car was stopped at the campground for 15 minutes.

e) When does the car arrive at the picnic park?

   The car arrived at the picnic park at 11:00 am.

f) How long did it take for the return trip?

   The return trip took 1 hour.

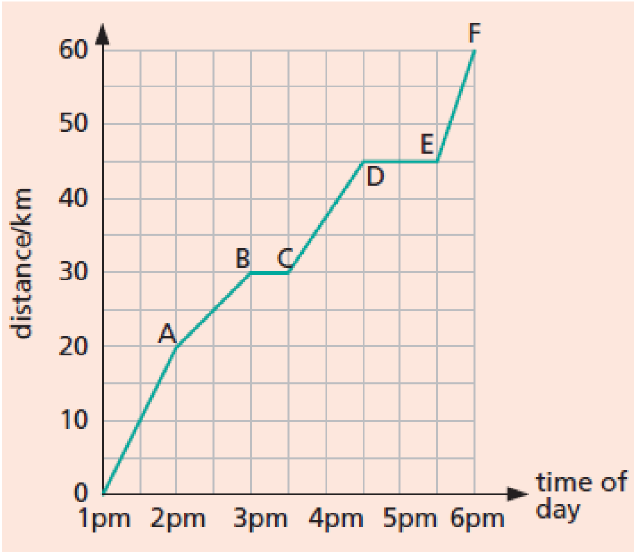
g) What was the speed of the car from home to the picnic park?

   The speed of the car from home to the picnic park was 40 mi/h

h) What was the speed of the car from the campground to home?

The speed of the car from the campground to home was 100 mi/h.

Q.2. The distance–time graph for a girl on a cycle ride is shown in Figure below.



a) How far did she travel?

b) How long did she take?

c) What was her average speed in km/h?

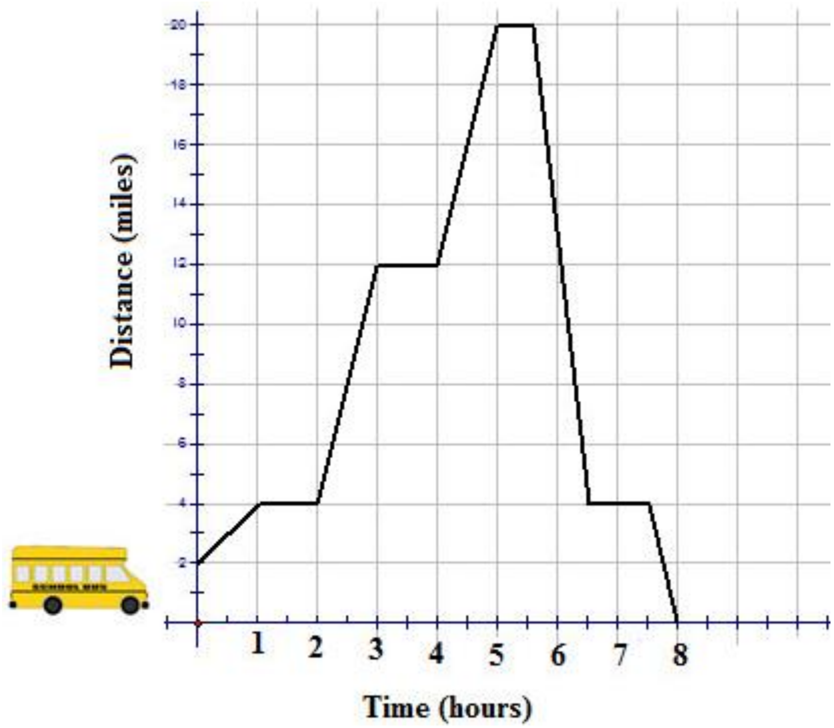
d) How many stops did she make?

e) How long did she stop for altogether?

f) What was her average speed *excluding* stops?

g) How can you tell from the shape of the graph when she travelled fastest? Over which stage did this happen?

Q.3. Answer the following questions from the graph shown below.



a) What was the fastest speed of the bus?

The fasted speed of the bus was 16 miles per hour.

b) How many times did the bus stop on its trip? (Do not count the beginning and the end of the trip.)

The bus was stopped 4 times.

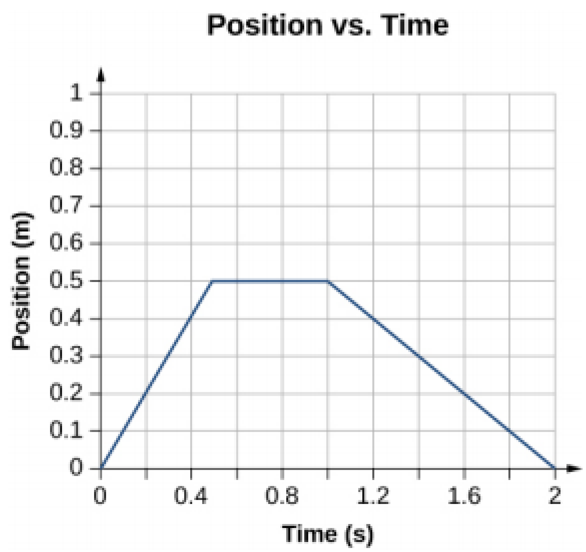
c) What was the initial distance of the bus from the bus depot?

The bus was initially 2 miles from the bus depot.

d) What was the total distance traveled by the bus?

The total distance traveled by the bus was 38 miles.

Q.4. Given the position-versus-time graph of Figure below, find the velocity-versus-time graph.



Solution

a) Time interval 0 s to 0.5

$$\bar{V} = \frac{0.5-0}{0.5-0} = 1.0\ m/s$$

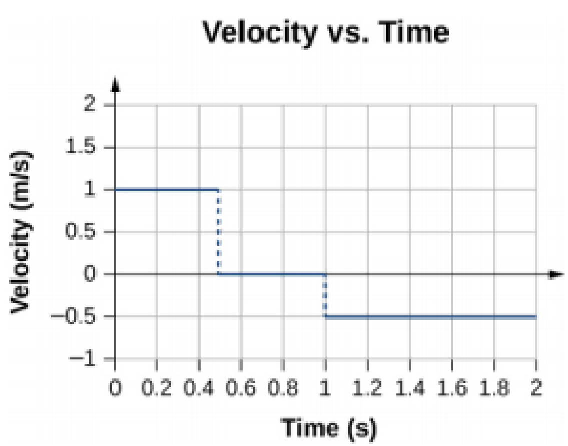
b) Time interval 0.5 s to 1.0

$$\bar{V} = 0$$

c) Time interval 1.0 s to 2.0

$$\bar{V} = \frac{0-0.5}{2-1} = -0.5\ m/s$$

d) The graph of these values of velocity versus time is shown below.



TOPIC P13

LGHT

Reflecting light

1. Light usually travels in straight lines. It changes direction if it hits a shiny surface, or if it travels from one material into another.
   This change in direction at a shiny surface such as a mirror is called reflection.

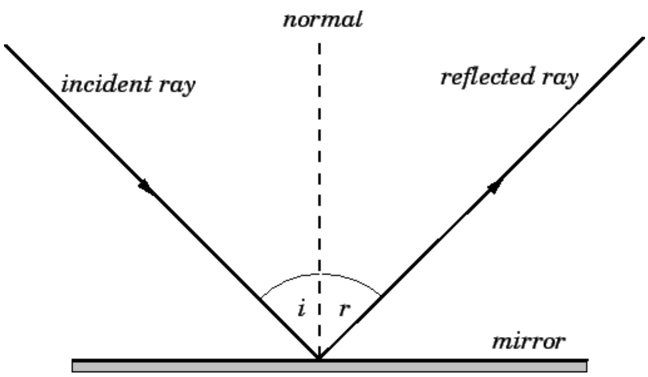


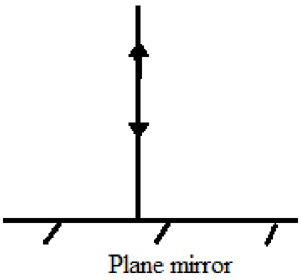
Figure 1 Reflection of light

2. Some facts about reflection of light;
   (i) Light remains in the same medium.
   (ii) Speed, wavelength and frequency all remains constant. Only the direction changes.
3. There are two laws of reflection
   a) First law: -Incident ray, normal and the reflected ray all lie in the same plane.
   b) Second law: - Angle of incidence is always equal to the angle of reflection, fig 1.

$$\angle i = \angle r$$

4. Normal: - A line drawn perpendicular to surface of mirror from the point of incidence is called normal.
5. Case of normal incidence: - When a ray falls normally on a mirror, it is reflected back on the same path and

$$\angle i = 0 = \angle r$$



Image

1. When two or more rays of light either meet or appear to meet after reflection form the mirror, an image is formed.

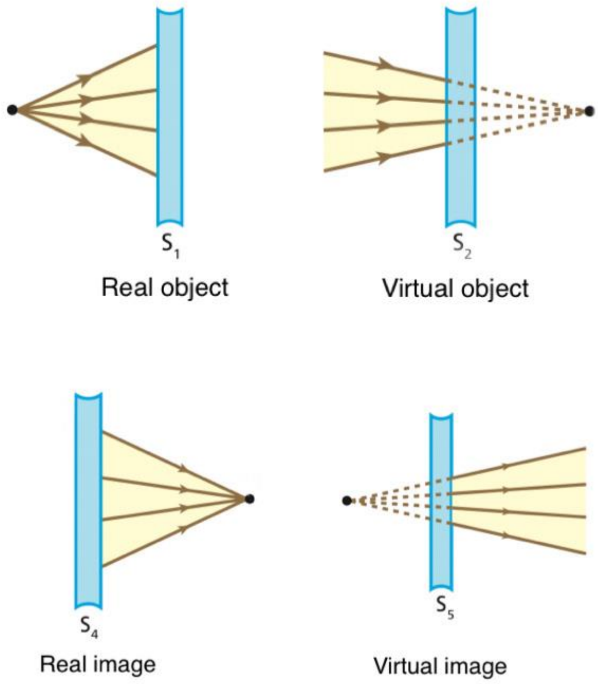
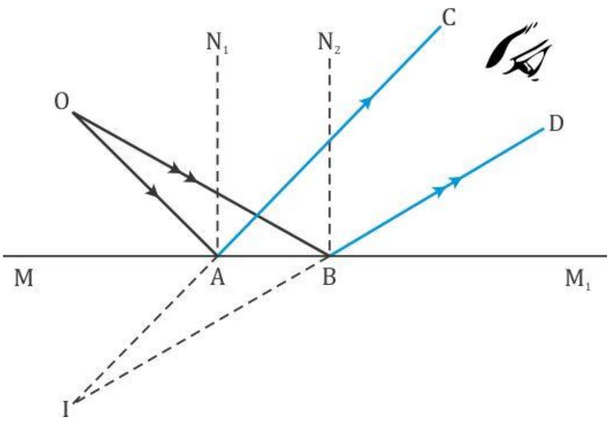


Figure 2 Real and virtual images

2. There are two types of images (a) real and (b) virtual
3. Real image
   a) If the reflected rays actually meet then the image formed is a real image, fig2.
   b) A real image is always inverted.
   c) It can be taken on a screen.
4. Virtual image
   a) If the reflected rays appear to meet then a virtual image is formed.
   b) A virtual image is always erect.
   c) It cannot be taken on a screen.

Image formation in a plane mirror

1. To draw image of a point object in a plane mirror, we consider any two rays coming from the object and draw their reflected rays, using laws of reflection. The reflected rays cannot meet in front of the mirror so we extend them in the backward direction and they appear to meet at a point. A virtual image is formed at that point.

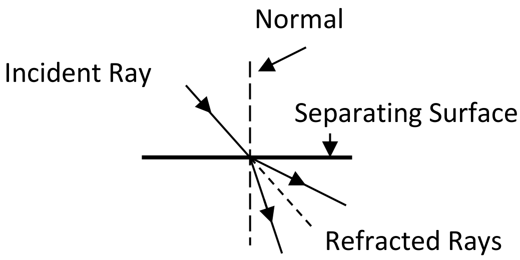


2. The images formed in a plane mirror has the following properties
   a) They are virtual, erect and of same size.
   b) They cannot be taken on a screen.
   c) They are laterally inverted i.e. left is turned right and vice-versa.
   d) In plane mirror the distance of the image with the mirror is same as that of object with the mirror.

https://opentextbc.ca/universityphysicsv3openstax/chapter/images-formed-by-plane-mirrors/

Refraction

1. The bending of light when it passes from one material (called a medium) to another is called refraction.



2. Some facts about refraction
   - The ray of light bends towards the normal when it goes from rare to denser medium and away from the normal when goes from denser to rare medium.
   - A ray emerging from a parallel-sided block is parallel to the ray entering, but is displaced sideways, like the ray in Figure 1a.

- A ray travelling along the normal direction at a boundary is not refracted (Figure 1b).

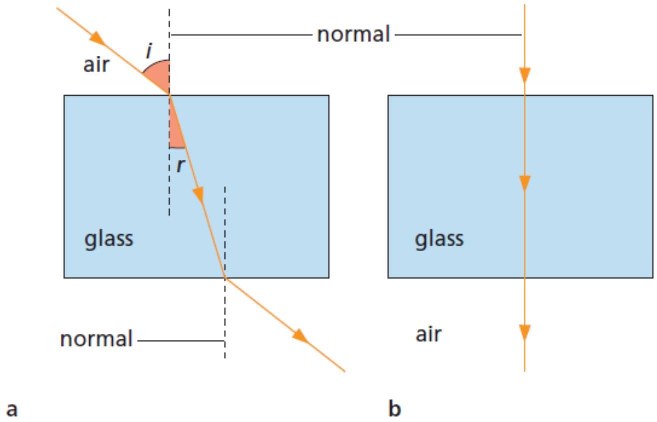


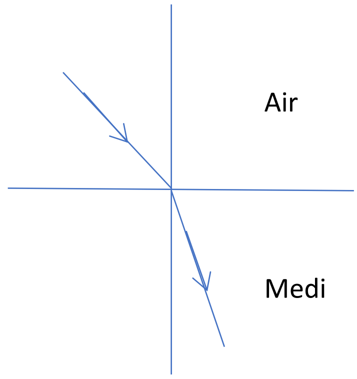
Figure 3 Refraction of light in glass

Refractive index

1. Refractive index is a pure number which characterizes or describes a medium.
2. It is a measure of how much the speed of light changes when it enters the medium from air.
3. There are two types of refractive indices.

(i) *Absolute refractive index*

a) It is the ratio of the speed of light in air or vacuum to the speed of light in that medium.



$$n = \frac{c}{v}$$

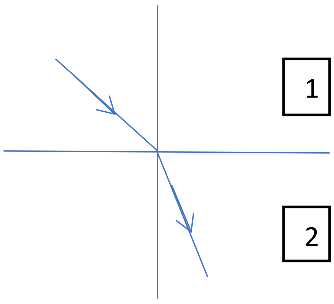
Where: c *and* v are the speeds of light in vacuum and the medium respectively.

b) Absolute refractive index of a medium is with respect to air.

c) Absolute refractive index of vacuum is minimum and is equal to 1. Absolute refractive index for any other medium is always *greater than 1*.

(ii) *Relative refractive index*

a) It is used when none of the media is air.
b) Relative refractive index of medium ‘2’ w.r.t. ‘1’ is defined as the ratio of absolute refractive index of medium ‘2’ (or the speed of light in medium 1) to the absolute refractive index of medium ‘1’ (or the speed of light in medium 2).



$$n_{21} = \frac{n_2}{n_1} ----(1)$$

But $n_1 = \frac{c}{v_1}$ *and* $n_2 = \frac{c}{v_2}$

Putting in above equation;

$$n_{21} = \frac{\left(\frac{c}{v_2}\right)}{\left(\frac{c}{v_1}\right)}$$

$$Or \quad n_{21} = \frac{v_1}{v_2} --- (2)$$

So; $\boldsymbol{n_{21} = \frac{n_2}{n_1} = \frac{v_1}{v_2}}$

c) Relative refractive index can be less than one too.

d) Refractive index of a medium depends on nature of medium and the wavelength of light.
e) A medium with larger refractive index (n) is optically denser.

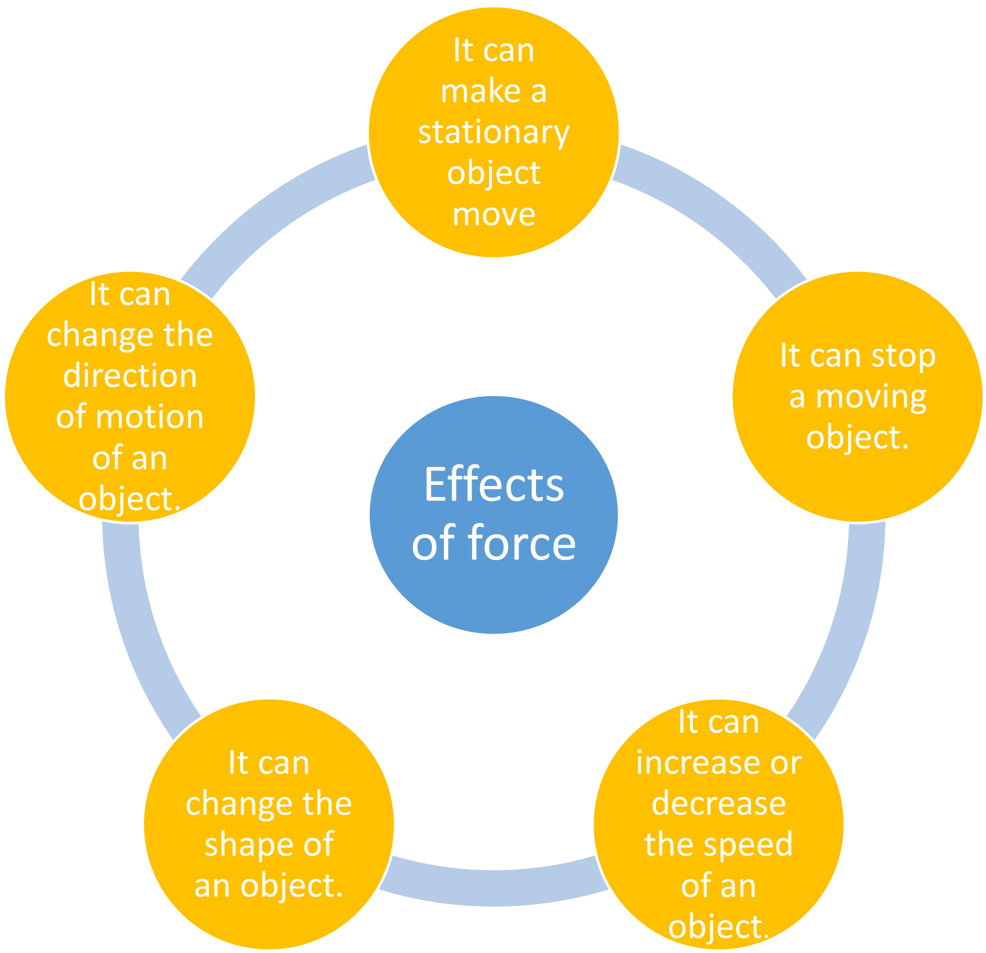
Larger the refractive index of a medium, greater is the bending of light when it enters the medium from air obliquely.

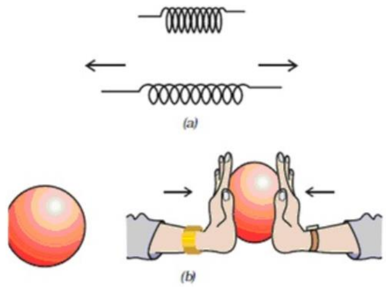
P03 FORCES AND MOTION

Force

1. Force is a push or pull which tries to change or changes the state of an object.

2. Things which force can do;





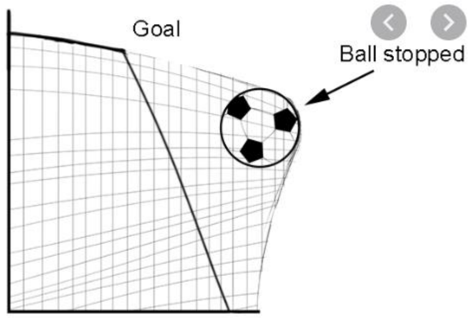


Figure 1Change in shape of an object *Figure 2 Force can make a moving object stop*

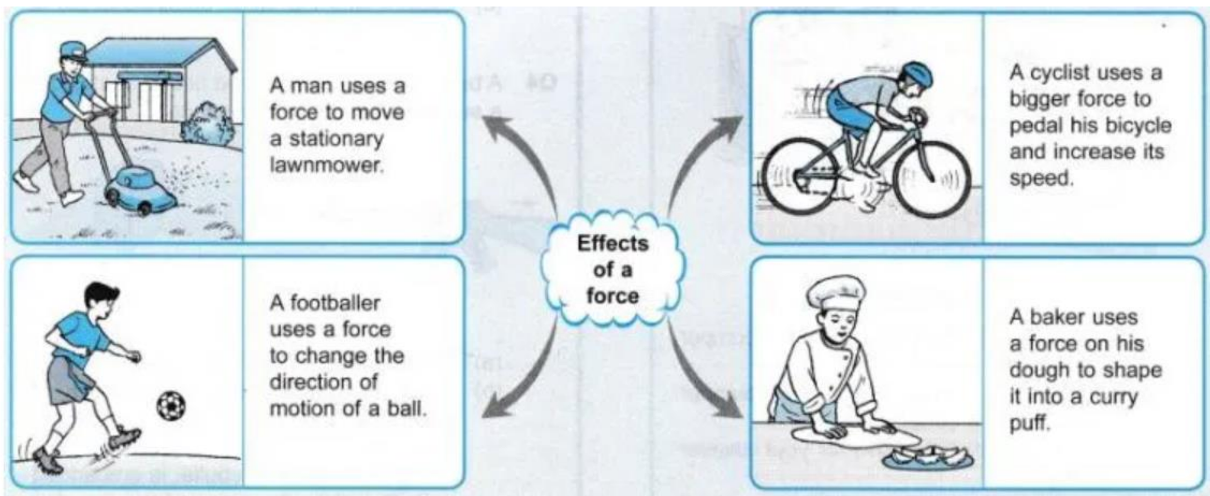


Figure 3 Effects of force

Figure 4Force can make a stationary object move

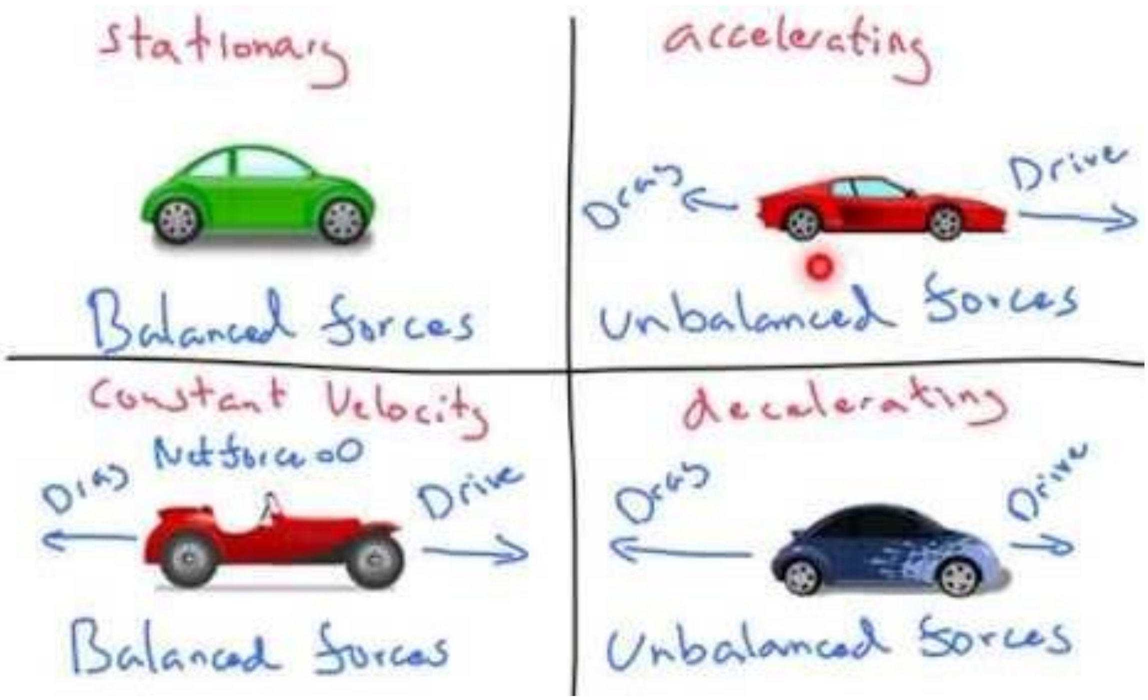
3. It is a vector quantity.
4. Its SI unit is N (newton).

Types of force

1. There are two types of forces;

Contact force	Non-contact force
1. A physical touch is required to apply such forces. 2. E.g. Muscular forces, force of friction etc.	1. It acts at a distance and no physical touch is required. 2. Force of gravity, magnetic force, electrostatic force etc.

Balanced force	Un-balanced force
1. If the vector sum of all the forces acting on an object is zero, such forces are called balanced forces. 2. The body is at rest or moves in uniform motion under such force.	1. If the vector sum of all the forces acting on an object is not zero, such forces are called unbalanced forces. 2. The body is into non-uniform motion.



Resultant force

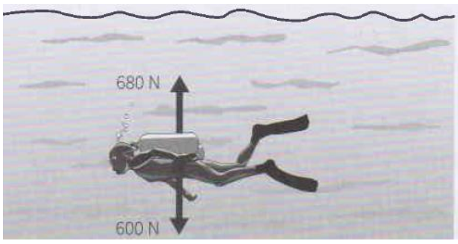
1. Resultant force is that single force which when applied gives the same effect as given by the actual forces.
2. If a body is at rest or in uniform motion and the resultant force acting on the body is zero, the body will continue in the same state.
3. If a body is at rest or in uniform motion and a non-zero resultant force acts on the body then the body will accelerate in the direction of the resultant force.

https://www.youtube.com/watch?v=B6mi1-YoRT4
https://www.youtube.com/watch?v=OijJ4EtTBi0

Assignment No 2_Phy_9 Camb_27th Jun 2020_Topic 3

1. An object may be acted on by several forces. What name is given to the single force that has the same effect as these forces.
2.
   a) What name is given to the force on an object caused by the earth's gravitational pull.
   b) What name is given to the force produced when two surfaces slide over each other.
3. The diagram shows the forces acting on a table tennis ball as it falls.

   a) Copy the diagram and label the force arrows *weight and air resistance*.
   b) The two forces are equal but opposite. What is the resultant force acting on the ball?
   c) Explain why the ball falls at a steady speed.
4. The diagram shows a diver underwater.



   a) Calculate the resultant force on the diver.
   b) Explain how his motion will change.
5. An astronaut is weighed before he sets off to the Moon. He has a mass of 80 kg.
   a) What will his weight be on Earth?
   b) When he arrives on the Moon, will his mass be more, less, or the same?
   c) Will his weight be more, less, or the same?

Topics covered on 27th June 20 online class 9 Camb_Physics

Weight

1. Weight is a force with which an object is attracted towards the centre of earth.
2. $W = mg$
3. Its SI unit is N.
4. The weight of an object is more on poles than on equator due to its oval shape.
5. The weight of an object is maximum on the surface of earth. If one goes above or below the surface of earth, his weight decreases.
6. Weight on the surface of moon is $1/6^{th}$ of that on the surface of earth.
7. Weight can be measured by spring balance.
8. Weight can change but not mass.

Upthrust

1. It is the upward push of a liquid or gas on an object.
2. Objects can float in a fluid only because of upthrust.
3. It is equal to the weight of the liquid displaced by an object.
4. It is also known as buoyant force.
5. An object dipped in a liquid loses its weight because of this upthrust and this phenomenon is known buoyancy.

Air resistance or drag

1. It is the resistance faced by an object moving through a liquid or gas.
2. It increases with the speed of the object.
3. It can be reduced by giving an aerodynamic shape to the moving object.

Contact force

1. When two bodies are in contact with each other, they exert equal and opposite force on each other called contact forces. They are always perpendicular to the surfaces in contact.

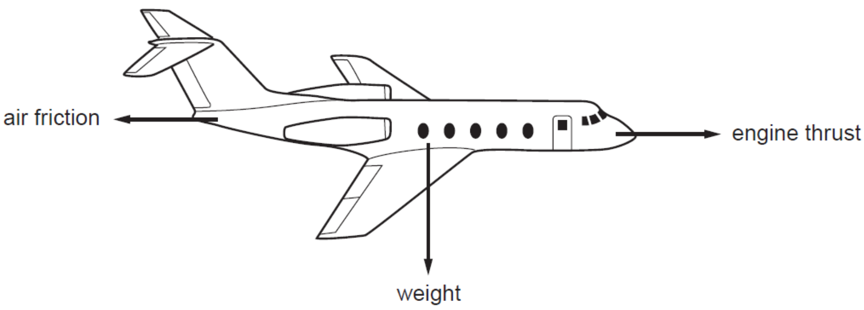
Mass and Weight

Mass	Weight
1. The quantity of matter contained in a body is called its mass. 2. It does not change. 3. Si unit of mass is kg. 4. $m = \frac{W}{g}$	1. The pull of gravity on an object is called its weight. 2. It can change from place to place. 3. SI unit of weight is N (newton). 4. $W = mg$

Assignment 3_Phy_Class 9 Camb_1st July_Topic 3

1. A force causes an object with mass to accelerate.
   a) Write the equation that links the quantities force mass and acceleration.
   b) What are the units of mass, force and acceleration?
2. Which will produce a bigger acceleration; a force of 10 N acting on mass of 5 kg, or a force of 5 N acting on a mass of 10 kg?
3. What force is needed to give a mass of 20 kg an acceleration of 5 m/s^2?
4. A train of mass 800000 kg is slowing down. What acceleration is produced if the braking force is 1400000 N?
5. A car speeds up from 12 m/s to 20 m/s in 6.4 s. If its mass is 1200 kg, what force must its engine provide?
6. The gravitational field of the Moon is weaker than that of the Earth. It pulls on each kg of mass with a force of 1.6 N. What will be the weight of a 50 kg mass on the Moon?
7. The diagram shows the forces acting on a lorry as it travels along a flat road.

   a) Two of the forces have effects that cancel each other out. Which two? Explain your answer.
   b) What is the resultant force acting on the lorry?
   c) What effect will the resultant force have on the speed at which the lorry is travelling?
8.
   a) An aero plane is flying horizontally at a steady speed in a straight line. The diagram shows three of the four forces acting on it.



i. In order to fly horizontally at a steady speed, which of the two forces shown on the aero plane must be equal?

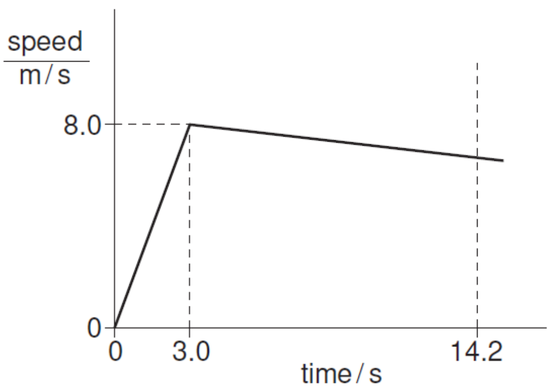
ii. In order to fly horizontally in a straight line, there must be a fourth force acting on the plane. Copy the diagram and draw an arrow to represent this force.

b) The aeroplane in Fig. above flies an outward journey from Budapest (Hungary) to Palermo (Italy) in 2.75 hours. The distance is 2200 km.

i. Calculate, in km / h, the average speed of the aeroplane.

ii. On the return journey from Palermo to Budapest, the journey time is shorter, even though the engine thrust is the same.
Suggest what might have caused the return journey to be shorter.

9. A young athlete has a mass of 42 kg. On a day when there is no wind, she runs a 100 m race in14.2 s. A sketch graph (not to scale) showing her speed during the race is given in Fig. below



a) Calculate

i. the acceleration of the athlete during the first 3.0 s of the race,

ii. the accelerating force on the athlete during the first 3.0 s of the race,

iii. the speed with which she crosses the finishing line.

Assignment 4_Class 9 Camb_Phy_3rd July 20

Q1. A stationary body is acted upon by a number of forces. State the two conditions which must apply for the body to remain at rest.

Q2. Fig. below shows an aeroplane of mass $3.4 \times 10^5\ kg$ accelerating uniformly from rest along a runway. Fig. below After $26\ s$ it reaches a speed of 65 m / s.

a) Calculate

i. the acceleration of the aeroplane,

ii. the resultant force on the aeroplane.

Mass & Weight

Question Paper 1

Level	IGCSE
Subject	Physics (0625/0972)
Exam Board	Cambridge International Examinations (CIE)
Topic	General Physics
Sub-Topic	Mass & Weight
Booklet	Question Paper 1

Time allowed: **18 minutes**

Score: **/14**

Percentage: **/100**

Grade Boundaries:

9	8	7	6	5	4	3	2	1
>85%	75%	68%	60%	55%	50%	43%	35%	<30%

A cup contains hot liquid.

Some of the liquid evaporates.

What happens to the mass and what happens to the weight of the liquid in the cup?

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

An astronaut in an orbiting spacecraft experiences a force due to gravity. This force is less than when she is on the Earth's surface.

Compared with being on the Earth's surface, how do her mass and her weight change when she goes into orbit?

	mass in orbit	weight in orbit
A	decreases	decreases
B	decreases	unchanged
C	unchanged	decreases
D	unchanged	unchanged

Diagram 1 shows a piece of foam rubber that contains many pockets of air. Diagram 2 shows the same piece of foam rubber after it has been compressed so that its volume decreases.

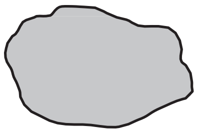


diagram 1
(before compression)

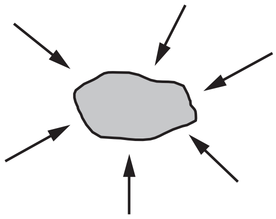


diagram 2
(after compression)

What happens to the mass and to the weight of the foam rubber when it is compressed?

	mass	weight
A	increases	increases
B	increases	no change
C	no change	increases
D	no change	no change

Weight is an example of which quantity?

A. acceleration

B. force

C. mass

D. pressure

The mass of an object is measured on Earth. The mass is 5.0 kg.

The object is taken to the Moon. The mass of the object is measured on the Moon.

What is the mass of the object on the Moon?

A. 0 kg

B. more than 0 kg, but less than 5.0 kg

C. 5.0 kg

D. more than 5.0 kg

Which statement about mass or weight is correct?

A. Mass is a force.

B. Mass is measured in newtons.

C. Weight is a force.

D. Weight is measured in kilograms.

What is the weight of an object?

A. the force of gravity on the object

B. the gravitational potential energy of the object

C. the internal energy of the object

D. the mass of the object

Which instrument is used to compare the masses of objects?

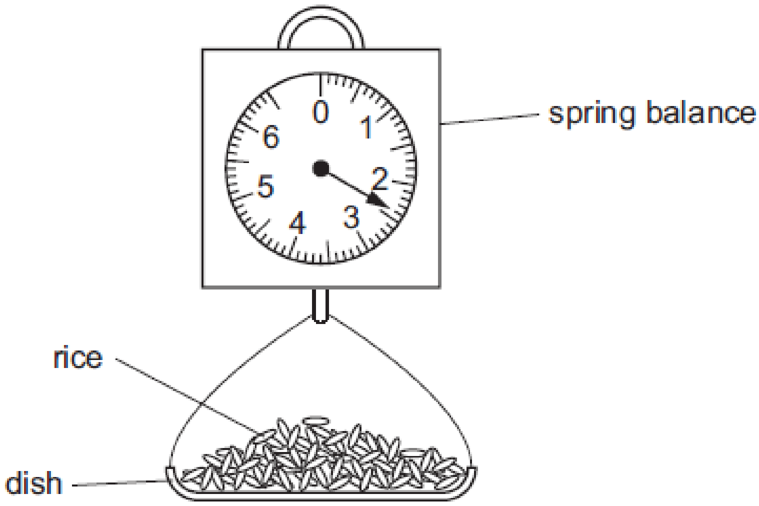
A. a balance

B. a barometer

C. a manometer

D. a measuring cylinder

A customer goes to a market and buys some rice. The stallholder pours rice into a dish that hangs from a spring balance. He records the reading on the spring balance.



The customer then buys some pasta and the stallholder notices that the reading on the spring balance, with just pasta in the dish, is the same as it was with just rice in the dish.

The rice and the pasta must have the same

A. density.

B. temperature.

C. volume.

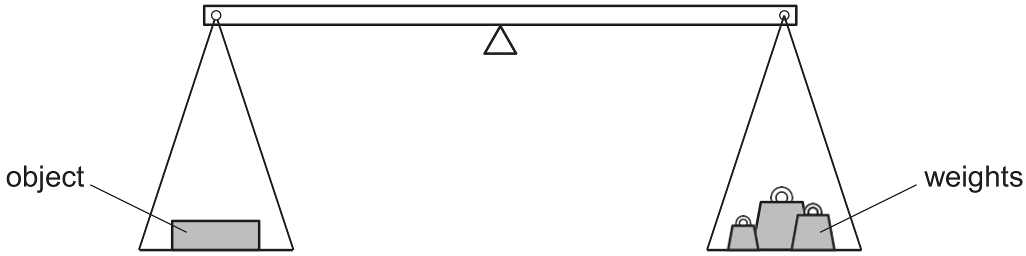
D. weight.

The mass of an astronaut is 70kg on the Moon.

What is the mass of the astronaut on the Earth?

A 7kg B 70kg C 80kg D 700kg

The weight of an object is found using the balance shown in the diagram. The object is put in the left-hand pan and various weights are put in the right-hand pan.



These are the results.

weights in the right-hand pan	effect
0.1 N, 0.1 N, 0.05 N, 0.02 N	balance tips down slightly on the left-hand side
0.2 N, 0.1 N, 0.01 N	balance tips down slightly on the right-hand side

What is the best estimate of the weight of the object?

A 0.27 N B 0.29 N C 0.31 N D 0.58 N

Which is the unit for force and which is the unit for weight?

	force	weight
A	kg	kg
B	kg	N
C	N	kg
D	N	N

Which quantity is measured in newtons?

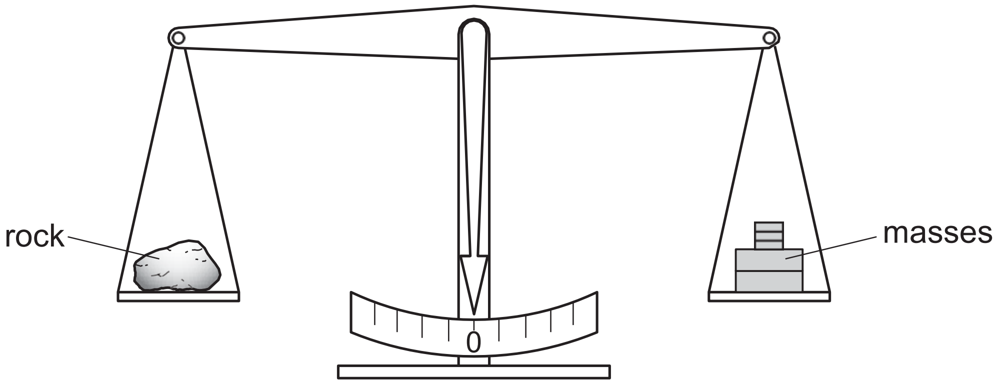
A. density

B. energy

C. pressure

D. Weight.

A geologist places a small rock on the left-hand pan of a balance. The two pans are level as shown when masses with a total weight of 23 N are placed on the right-hand pan. Take the weight of 1.0 kg to be 10 N.

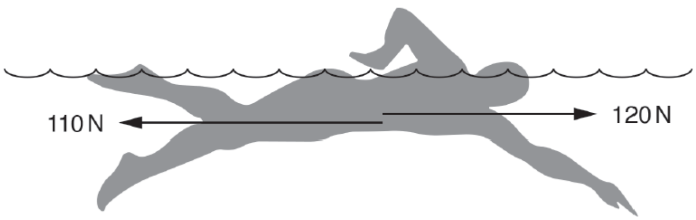


What is the mass of the small rock?

A 0.023 kg B 2.3 kg C 23 kg D 230 kg

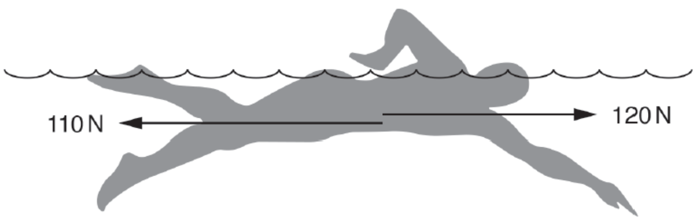
Assignment No 6_Phy_9Camb_10th July_Topic 3

Q1. The diagram shows the horizontal forces acting on a swimmer.



State the name of the 110N force on the swimmer.

Q2. The diagram shows the horizontal forces acting on a swimmer.



Calculate the size and direction of the resultant horizontal force on the swimmer.
size of resultant horizontal force = ... N
direction of resultant horizontal force = ...

Q3. A student measures the mass of a piece of metal. Its mass is 146 g.
State the name of the instrument used to measure the mass.

....

Q4. State **two** properties of an object that may be changed by the action of forces.

1. ....

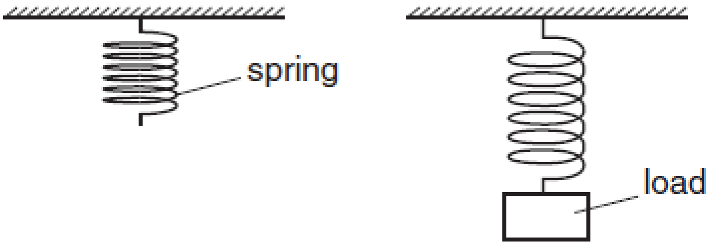
2. ....

Q5. The mass of a wheelbarrow is 20 kg. The mass of the load in the wheelbarrow is 30 kg.
Calculate the total weight of the wheelbarrow and its load.

Weight of wheelbarrow and its load = ... N

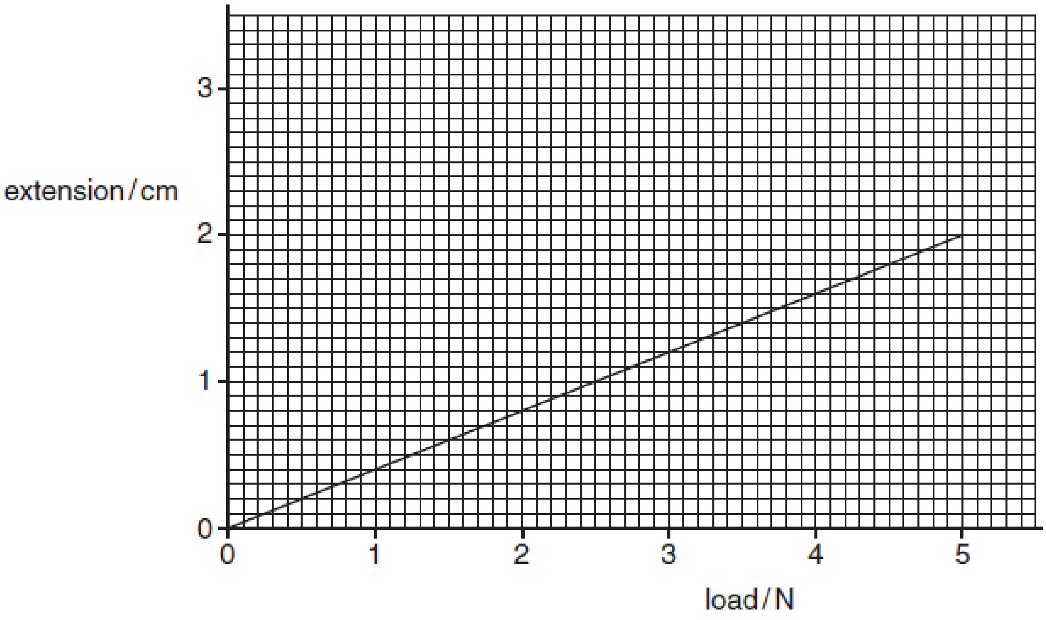
Assignment 7_31st July_Class 9_Physics

Q.1. Fig. given below shows a spring before and after a load is added.



a) What is meant by the *extension* of the spring?

b) When the graph of extension against load is drawn for the spring, the result is the line shown in Fig. given below.

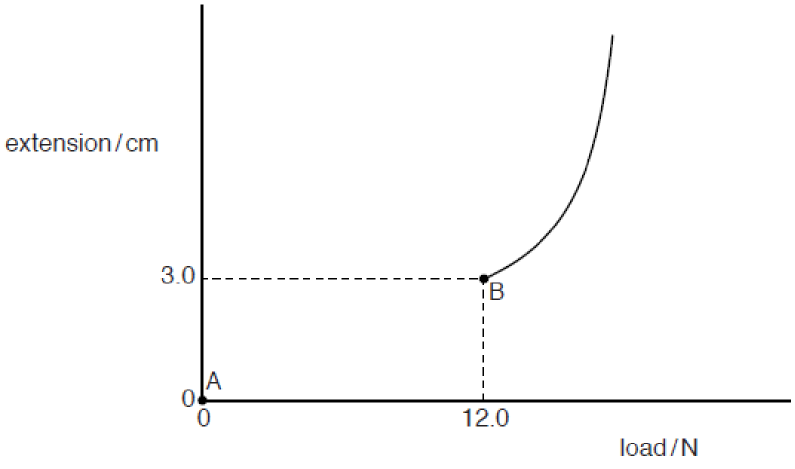


i) The un-stretched length of the spring is 9.0 cm.

1. Calculate the total length of the spring when a 5.0 N load is hanging from the spring.
2. Find the extension that will be caused by a load of 2.0 N.

ii) Calculate the mass of a load of weight 2.0 N.

Q.2. Fig. below shows part of the extension-load graph for a spring.



The spring obeys Hooke's law between points A and B.

a)

i) On Fig. above, complete the graph between A and B.

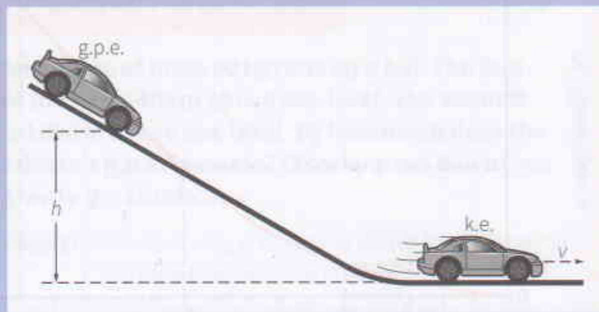
ii) State the name of point B.

b) The average value of the load between A and B is 6.0 N.
Calculate the work done in extending the spring from A to B.

c) The spring has an upstretched length of 4.0 cm.
An object is hung on the spring and the spring length increases from 4.0 cm to 6.0 cm.

i) Calculate the mass of the object.

ii) The object is immersed in a liquid but remains suspended from the spring.
The liquid exerts an upward force on the object and the length of the spring decreases to 5.0 cm.
Calculate the upward force exerted on the object by the liquid.



Your task is to test the following idea:

As it runs down the slope, the car's g.p.e. is *entirely* converted to k.e.

1. Start by discussing whether you think this idea is likely to be true.
2. Discuss how you can test the idea. What will you have to measure? What factors can you vary in the course of the experiment?
3. Make your measurements and draw a conclusion.

QUESTIONS

P6.15 In the following examples, is the object's g.p.e. increasing, decreasing or remaining constant?

- **a** An apple falls from a tree.
- **b** An aircraft flies horizontally at a height of 9000 m.
- **c** A sky-rocket is fired into the sky.

P6.16 A girl of weight 500 N climbs on top of a 2.0 m high wall. By how much does her g.p.e. increase?

P6.17 A stone of weight 1.0 N falls downwards. Its g.p.e. decreases by 100 J. How far has it fallen?

P6.18 What does v represent in the formula k.e. = $\frac{1}{2}mv^2$?

P6.19 How much k.e. is stored by a 1.0 kg ball moving at 1.0 m/s?

P6.20 A runner of mass 80 kg is moving at 8.0 m/s. Calculate her kinetic energy.

P6.21 Which has more k.e., a 2.0 g bee flying at 1.0 m/s, or a 1.0 g wasp flying at 2.0 m/s?

Summary

You should know:

- about forms of energy and energy conversions
- the principle of conservation of energy
- what is meant by energy efficiency
- how to calculate energy efficiency
- how to calculate gravitational potential energy and kinetic energy.

End-of-chapter questions

1 Copy and complete the table by giving the name of each form of energy in the first column.

Name	Description
	energy of a moving object
	energy stored in a hot object
	energy stored in a fuel
	energy that we can see
	energy that we can hear
	energy stored in a squashed spring
	energy carried by an electric current
	energy stored in the nucleus of an atom
	energy escaping from a hot object

2 What are the energy conversions in each of the following? Write an equation for each.

a A glow-worm is an insect that glows in the dark. Chemicals in its body react together to produce light and heat. [2]

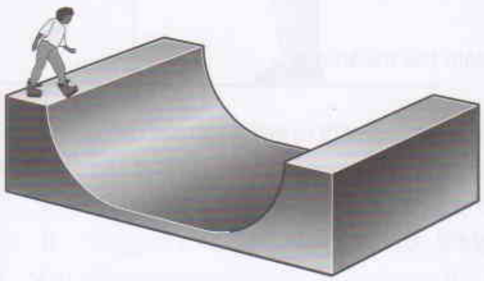
b An electric motor is used to start a computer's disk drive spinning round. [2]

c A wind turbine spins and generates electricity. [2]

d Friction in a car's brakes slows it down. [2]

3 A light bulb is supplied with 100 J of electrical energy each second. It produces 7.0 J of light energy and 93.0 J of thermal (heat) energy. Explain how this shows that energy is conserved. [3]

4 The girl on the skate ramp roller-skates down one side of the slope and up the opposite side. She cannot quite reach the top of the slope, level with her starting position.



a What energy conversion is taking place as the girl moves downwards? [2]

b What energy conversion is taking place as the girl moves back upwards? [2]

c Explain why the girl cannot reach the top of the slope. [2]

d Suggest how the girl could reach the top of the slope. [2]

5 Energy can be changed from one form to another. It can be transferred from one object to another. Copy and complete the following sentences.

a When energy changes from one form to another, some of the energy may be wasted, often in the form of .... [1]

b The .... tells us the fraction of energy which is wasted. [1]

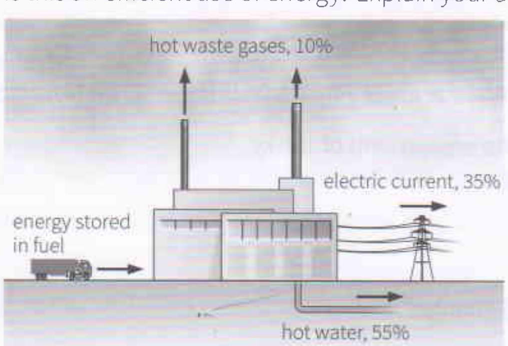
c The total amount of energy does not change. This is known as the principle of .... of energy. [1]

6 A power station burns rubbish to generate electricity. It also supplies hot water to nearby offices and shops.

a What **two** useful energy forms are produced? [2]

b What waste energy is produced? [1]

c Is this an efficient use of energy? Explain your answer using information from the diagram. [2]



7 The diagram represents an energy change.

Copy and complete the following two word equations for this energy change:

a waste energy = **[2]**

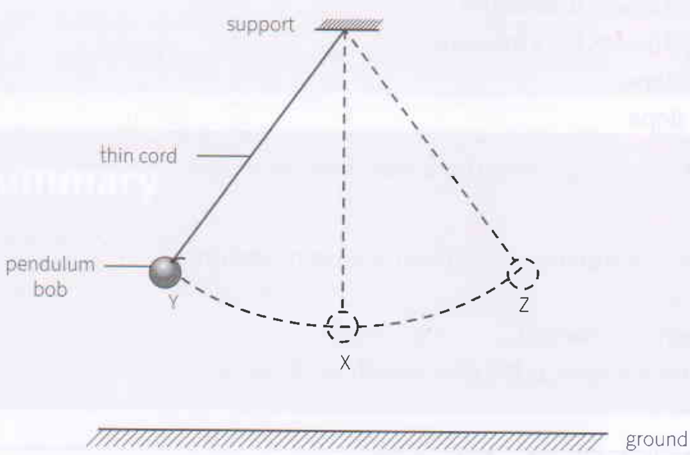
b efficiency = **[2]**

8 Give the equations used to calculate the following quantities; and explain the meanings of the symbols used for each.

a kinetic energy **[3]**

b gravitational potential energy **[4]**

9 A simple pendulum starts with its bob at position X, shown in the diagram. The bob is pulled aside to Y and then released. It swings from Y to Z and back to Y.



Copy the following sentences, and write suitable words in the gaps. Ignore air resistance. **[5]**

In order to move the bob from X to Y, ... has to be done on it and its .... energy increases because it is raised further from the ground. As it moves towards X, some of this energy is converted into .... energy. Throughout the swing from Y to Z and back to Y, the total energy is .... Energy is measured in units called ....

[Cambridge IGCSE Physics 0625 Paper 22 Q4 November 2010]

10 An astronaut on the Moon has a mass (including his spacesuit and equipment) of 180 kg. The acceleration due to gravity on the Moon's surface is $1.6\ m/s^2$.

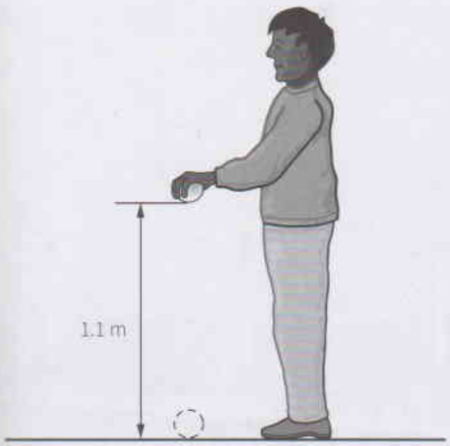
a Calculate the astronaut's weight on the Moon. **[3]**

The astronaut climbs 100 m to the top of a crater.

b By how much does his gravitational potential energy (g.p.e.) change? **[3]**

c Does his g.p.e. increase or decrease? **[1]**

11 A boy drops a ball of mass 0.50 kg. The ball falls a distance of 1.1 m, as shown in the diagram.
Ignore air resistance throughout this question.



a Calculate the decrease in gravitational potential energy of the ball as it falls through the 1.1 m. **[2]**

b The ball bounces and only rises to a height of 0.80 m.

i Calculate the energy lost during the bounce. **[1]**

ii Suggest one reason why energy is lost during the bounce. **[1]**

c On another occasion, the boy *throws* the ball down from a height of 1.1 m, giving it an initial kinetic energy of 9.0 J.
Calculate the speed at which the ball hits the ground. **[3]**

[Cambridge IGCSE Physics 0625 Paper 33 Q6 November 2010]