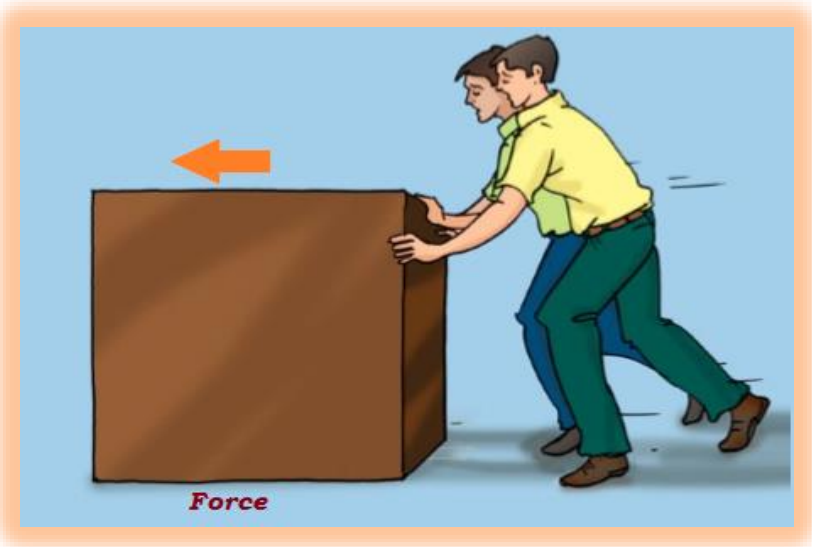
PHYSICS KNOWLEDGEBASE

2020

FORCE



TEACHERS OF PHYSICS
www.teachersofphysics.com
11/21/2020

1. Define force and give its **SI** units

Force refers to a push or a pull that result from interaction of bodies.

The SI unit of force is ***the newton (N).***

2. Name two effects of force

Force can make stationary object move.

It can increase speed of moving object.

It can stop a moving object.

It can decrease speed of moving object.

It can change shape of an object (i.e. can deform an object).

It can make an object turn about a fixed point (pivot). This is called turning effect of force.

It can change the direction of a moving object.

3. State the reason why it is not correct to quote the weight of solid objects in kilograms (1mk)

Because ***Weight*** *is the gravitational pull on a body. It is a force and therefore its SI unit is* ***Newton (N) while kilograms are SI unit for mass.***

4. Name the type of force that**:** **(4mk)**

(i) Attracts bodies toward the centre of the earth.

Gravitational force

(ii) Opposes motion between two surfaces in contact.

Frictional forces.

(iii) Makes an object appear lighter when being lifted out of water.

Upthrust force

(iv) Attracts pieces of papers to a plastic ruler when the ruler is rubbed on hair.

Electrostatic force

(v) Enables a body to move in a circular motion

Centripetal force

SURFACE TENSION

1. What is surface tension? (1mk)

Surface tension is the force that makes the surface of the liquid to behave like a fully stretched elastic skin.

2. State **two** factors that lowers the surface tension force on a water surface.

i. *Addition of impurities*

ii. *Increasing the temperature of water.*

3. State one way of making the surface tension of a liquid stronger. (1 mk)

i. *Decreasing impurities*

ii. *Lowering the temperature of water.*

4. State the effect of a decrease in temperature on surface tension. 1mk

Temperature reduces surface tension of the liquid because it weakens cohesive force of attraction between liquid molecules.

5. A steel needle placed on water is found to float even though steel is denser than water. But when the water is heated the needle sinks. Explain why.

The needle floats on water because it is held by surface tension of water. When water is heated the surface tension breaks hence needle sinks.

6. Explain a metal pin was observed to float on the surface of pure water. However the pin sank when a few drops of soap solution were carefully added to the water. (1mk)

The pin floats on water because it is held by surface tension of water. When few drops of soap solution were added to the water the surface tension breaks hence pin sinks.

7. Explain the washing effect of soap. (1mk)

The soap molecules act as mediator between water and oil molecules, and bind with both of them at the same time. This breaks cohesive forces between water molecules which is responsible for surface tension force.

8. If a tent is touched with a finger on inner surface, when it is raining, it allows the rain water to leak through. Give a reason for this observation. (1mk)

The surface tension of water in the tent is broken because of high temperature from the body hence the water leaks.

9. The diagram below shows a wire loop with two threads tied across it. The loop is dipped into a soap solution such that the soap film covers it as shown.

Region **B** is punctured such that the soap film in that section is broken. On the space alongside the diagram sketch the resulting shape of the wire loop. Give a reason for the shape. (2mks)

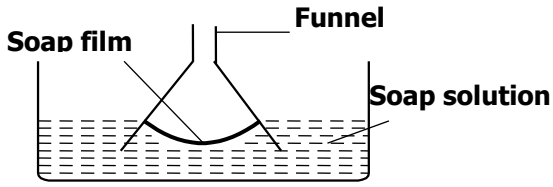
Because the thread is being pulled on both sides by equal forces of surface tension.

10. The diagram below shows a wire loop with a thread tied across it. The loop is dipped into a soap solution such that the soap film covers it as shown.

Region **X** is punctured such that the soap film in that section is broken. On the space alongside the diagram sketch the resulting shape of the wire loop. Give a reason for the shape. (2mk)

A perfect curve is formed because the thread is being pulled on both sides by equal forces of surface tension.

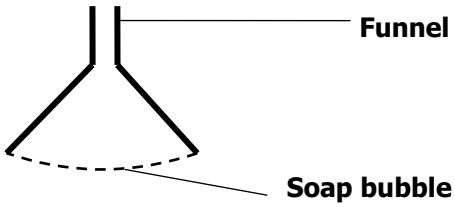
11. Figure shows a funnel dipped into a liquid soap solution.



State and explain what happens to the soap bubble when the funnel is removed. (2mk)

The bubble flattens to a film and the film slowly rises up the funnel because soap bubble behaves as if its surface is tightly stretched.

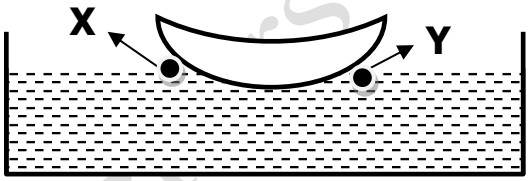
12. A glass funnel is dipped in soap solution, then taken out and blown gently to form a soap bubble as shown below



Explain why the bubble flattens to a film which then rises up the funnel. (2mks)

Because the soup bubble behave as if its surface is tight stretched skin.

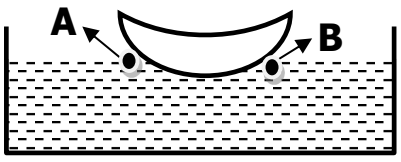
13. The figure below shows a small toy boat floating on water in a basin. X and Y are two point near the toy.



When a hot metal rod is dipped into the water at point X, the toy is observed to move towards **Y**. Explain this observation. 2mk

The temperature in point x tends to weaken surface tension at that point hence the other side y having a greater surface tension pulls the toy boat.

14. The Figure below shows a toy boat. A piece of soap is attached to end **A** and then the toy placed on a surface of clean water.



Explain the observation that would be made immediately. (**2mks)**

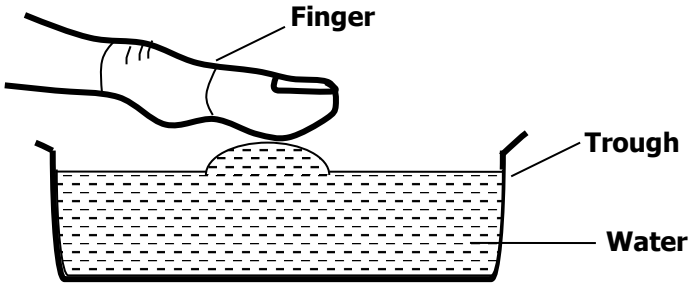
The toy boat moves towards B. Because the soap at point A breaks the surface tension hence B having greater surface tensions pulls the toy boat towards that direction.

ADHESIVE AND COHESIVE FORCE

1. Differentiate **cohesive** force from **adhesive** force. **(2mk)**

Cohesion refers to the force of attraction between molecules of same kind e.g. force of attraction between water molecules while adhesion refers to the force of attraction between molecules of different kind e.g. force of attraction between water and glass molecules.

2. Anyango placed her finger on a water as shown in the diagram below



Name the force that lifts the water to the finger (1mk)

Adhesion force.

3. Explain the reason why water spilled on a glass surface wets the surface. *adh* (1mk)

Adhesion force between the water molecules and the glass molecules are greater than cohesive force between water molecules.

4. When building a house using bricks a damp course is laid just above the brick foundation. Explain why the damp course is necessary (1**mk**)

This is because damp course has no air space for capillary of water moves up from one brick to another.

5. Name **two** types of forces which can act between objects without contact.

i. Gravitational force
ii. Magnetic force
iii. Electrostatic force

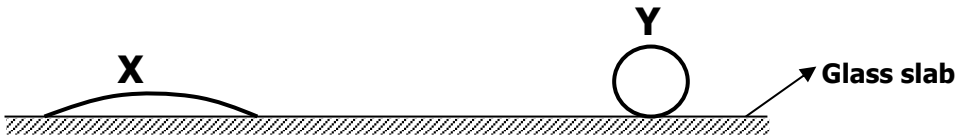
6. Name **two** types of forces which can act between objects in contact.

i. Upthrust force
ii. Frictional force
iii. Action and reaction force

7. Give a reason why lamp – wicks are usually made of cotton. (1mk)

Cotton has fibre which act like capillary tube of fine bores.

8. The diagram below shows drop of liquids X and Y carefully put on a clean flat glass slab



Explain the shapes of the drops (2mks)

X – water in a clear glass because of adhesive force between and water molecules are stronger than cohesive force.

Y – water in waxed glass surface it rolls into small droplets because waxed surface reduces adhesive force between water and glass molecules.

9. **Explain** why you can dry your hands with a towel but not with a sheet of polythene (1mk)

The towel has air spaces which provides fine tube for drying.

10. When drops of water are sprinkled on a greasy glass plate they form spherical shapes. Explain.

The shapes appears spherical because force of adhesive between water molecules and greased surface is lower than the cohesive force between water molecules.

11. Name **two** kinds forces that determine the shape of a liquid drop on solid surface.

Cohesive and adhesive force.

12. State **two** factors which determine the height to which a liquid rises up a capillary tube If dipped into the liquid. (2 mk)

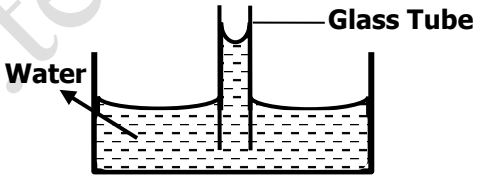
i. Size of the glass tube

ii. Nature of the material used.

13. Explain the following observation. Rain drops falling freely are spherical (1mk)

The droplets are spherical because the water molecules are held together by strong cohesive force than adhesive force.

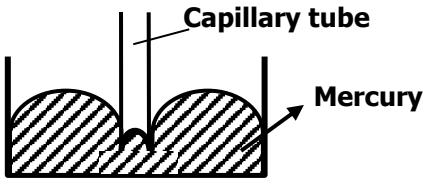
14. Fig shows the meniscus of water in a glass tube.



Explain why the meniscus of the liquid is shaped as shown. 2mk

The shape is concave meniscus because water wets glass thus adhesive force between them is stronger than cohesive force.

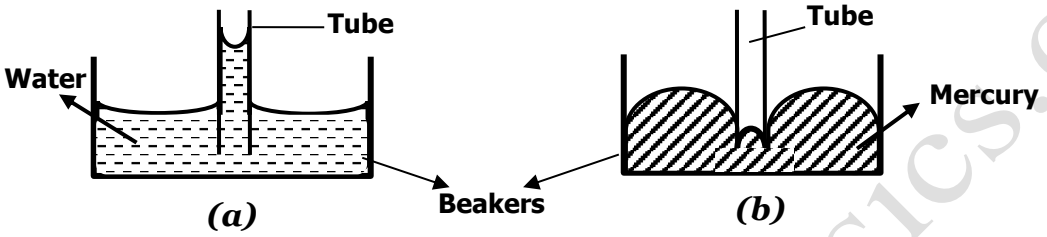
15. The diagram below shows the behaviour of mercury in a capillary tube.



Explain the behaviour 2mk

This is due to stronger cohesive force between mercury molecules than adhesive forces between mercury and glass molecules.

16. The figures **(a)** and **(b)** below shows capillary tubes inserted in water and mercury respectively.



It is observed that in water the meniscus in the capillary tube is higher than the meniscus in the beaker, while in mercury the meniscus in the capillary tube is lower than the meniscus in the beaker. Explain these observations.(2mk)

In water adhesive force between water and glass molecules is greater than cohesive force between water and water molecules while in mercury cohesive force between mercury and mercury molecule is greater than adhesive force.

17. The figures **(i)** and **(ii)** below shows two capillary tubes dipped in water and mercury respectively.

i) Indicate on the diagrams above the likely levels of water and mercury in the respective tubes. (1mk)

ii) Explain your answer in **(i)** above. (2mk)

In mercury cohesive force between mercury and mercury molecule is greater than adhesive force.

18. The diagram below shows a capillary tube immersed in water.

Using figure (b) sketch to show the appearance of the capillary tube if it was inserted in mercury.

19. The diagram below shows two clear glass tubes containing water and mercury

(a) (b)

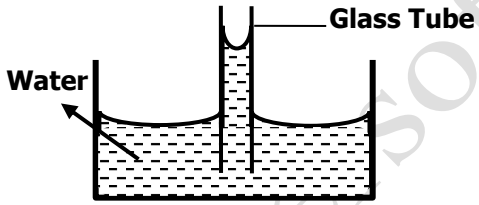
Explain the shapes of the surface of each of the liquids inside the tube. (2mk)

In (a) water curves upwards because adhesive force is stronger than cohesive force. In (b) mercury curves downwards because cohesive force is stronger between mercury-mercury molecules than adhesive force between mercury-glass molecules.

20. Figure a & b below shows narrow tubes dipped in mercury and water respectively.

The temperatures of the two liquids in the containers are raised slightly. Indicate the new levels of mercury and water in the tubes respectively. (1 mk)

21. Figure shows a narrow tube dipped in water.



The temperature of the liquid (water) is raised. Indicate on the diagram the new level of water. Explain your answer. (2mks)

MASS AND WEIGHT

1. State **three** differences between mass and weight. **(3mk)**

Mass	***Weight***
The quantity of matter in an object body	*Gravitational pull on an object*
The SI unit kg (kilogram)	*SI unit is the newton*
Constant everywhere	*Varies from place to place*
A scalar quantity	*A vector quantity*
Measured using a beam balance	*Measured using a spring balance*

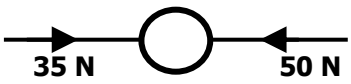
2. State the reason why it is not correct to quote the weight of solid objects in kilograms (1mk)

*Because **Weight** is the gravitational pull on a body. It is a force and therefore its SI unit is **Newton (N) while kilograms are SI unit for mass.***

3. Differentiate vector quantity from a scalar quantity and give an example of each

*A vector quantity is one with **both magnitude** and **direction** e.g. Weight, Force, Velocity ,Momentum, Acceleration, Displacement. A scalar quantity is one with **magnitude only** but no direction e.g. Time, Temperature, Energy, Speed, Area, Volume, Length, Mass, Distance.*

4. Using a scale of 1cm to represent 10N, draw a diagram to show the direction and magnitude of the resultant force for two forces acting as shown below. (1mk)

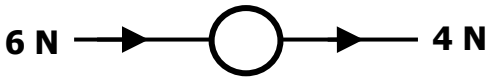


5. Show diagrammatically how you can combine forces of:

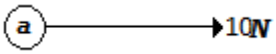
(a) **9N, 7N** and **2N** to give a resultant force of **4 N** (2mk)

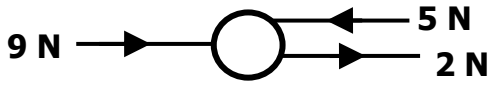
(b) **3N, 5N** and **7N** to give a resultant force of **15 N.** (2mk)

6. Determine the resultant vector due to the forces below

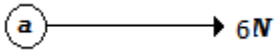
(i) 

$(+6\,N) + (+5\,N) = +10\,N$



(ii) 

$(-5\,N) + (+2N) + (+9\ N) = +6\,N$



7. The fig (I) below shows a body acted on by two forces $\mathbf{F_1=3N}$ and $\mathbf{F_2=8N}$

Fig I

On the fig (II) below draw the force $\mathbf{F_3}$ that has the same effect on the body as the two forces. (2mk)

Fig II

8. Show diagrammatically how you can combine forces of **9N** and **2N** to give a resultant force of

i) 7 N

ii) 11 N

9. Show diagrammatically how you can combine forces of:

(b) **9N, 7N** and **2N** to give a resultant force of **4 N**

(c) 3N, 5N and **7N** to give a resultant force of **15 N.**

10. Show diagrammatically how you can combine forces of: **12N, 7N** and **5N** to give a resultant force of

(i) **24N**

(ii) **0N**

(iii) **14N**

(iv) **10N**

11. Show diagrammatically how you can combine forces of: **18N, 7N** and **6N** to give a resultant force of **15N** **(2mk)**

12. A student was heard saying "the mass of a ball on the moon is one sixth its mass on earth". Give a reason why this statement is wrong.

The mass of the body does not change from place to place/ from one planet to the other.

13. The weight of a person increases as one move away from the equator towards the poles. Give a reason for this.

The earth is flatter at the poles such that the distance between the centre of the earth and the poles is shorter than the radius of the earth at the equator. This implies that the force of attraction between the surface of the earth and its centre is greater at the poles than at the equator.

14. Give a reason why the weight of a body varies from place to place.

Weight of a body changes from place to place due to change in value of gravitational pull.

15. A bag of sand is found to have the same weight on planet earth as an identical bag of cotton on planet Jupiter. Explain why the masses of the two bags must be different. (2mk)

Weight is given by W = mg. m = W/g. the value of gravitational force on planet Jupiter is greater than that on earth. This makes weight of bag feather the same as on earth.

16. Explain a bag of sugar is found to have the same weight on planet moon as an identical bag of dry saw dust on the earth. (1mk)

Moon is smaller than earth hence has a small gravitational pull compared to earth which is bigger in size.

17. An astronaut weighs **800 N** on earth where **g=10N/kg**. Calculate

i) His mass

M = W/g = 800/10 = 80kg

ii) His weight on the moon where **g=1.6N/kg**

W = mg = 80 x 1.6 = 128N

18. An astronaut weighs **800 N** on mars where **g=16N/kg**. Calculate

i) His mass

M =W/g = 800/16 = 50kg

ii) His weight on Jupiter where **g=20N/kg.**

w=mg = 50 x 20 = 1000N

19. An object weighs **600 N** on Earth. What would its weight be on another planet of gravitational acceleration **8 N/kg**.

M =W/g = 600/10 = 60kg

W = mg = 60x80 = 480N

20. A body weighs **600N** on the surface of the earth where **g = 10N/Kg** and **150N** on the surface of Venus. Calculate the value force of gravity on Venus.

M =W/g = 600/10 = 60kg

G = w/m = 150/60 = 2.5N

21. An astronaut weighs **1200 N** on Jupiter which has gravitational strength of **20N/Kg**. Calculate

i) His mass on Jupiter

M =W/g = 1200/20 = 60kg

ii) His weight on the Earth.

W = mg = 60x10 = 600N

22. The weight of a stone on the moon is found to be **48N.** Determine its weight on earth given that the gravitational force on the moon is **1.6N/kg**

M =W/g = 48/1.6 = 30kg

W = mg = 30x10 = 300N

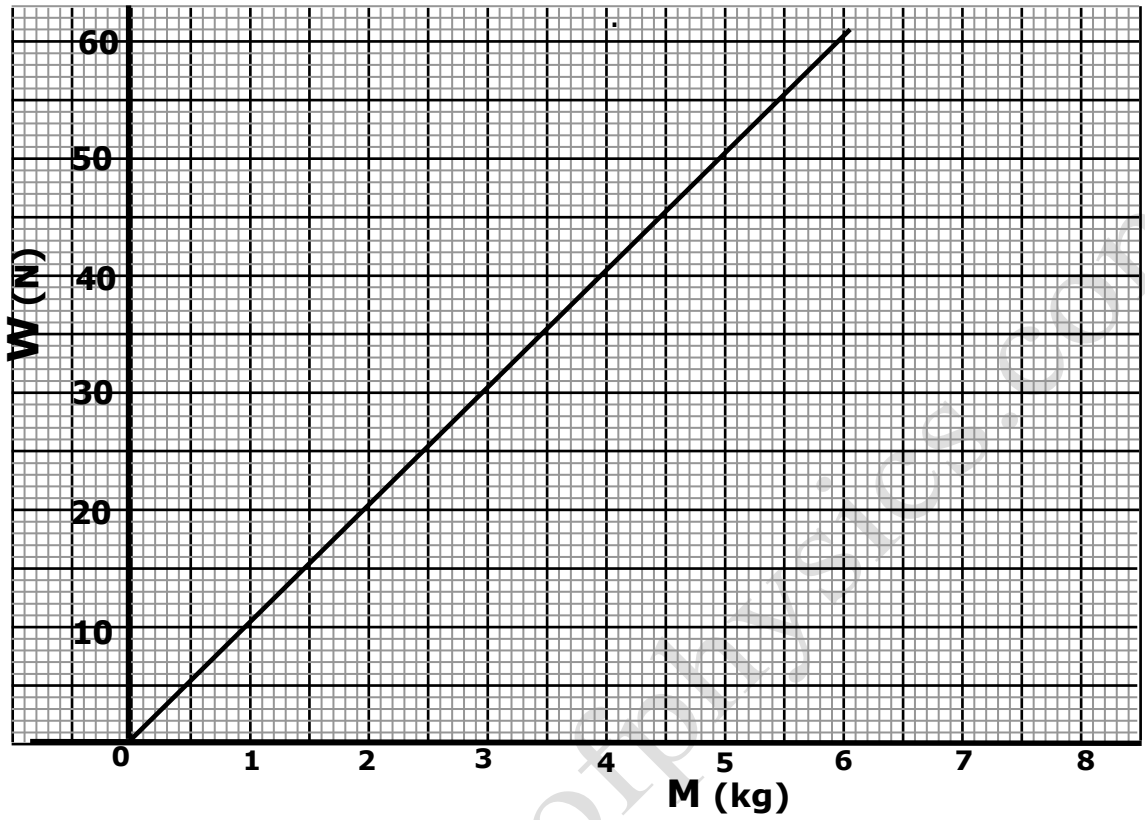
23. An object weighs **8.0 N** on Earth. What would its weight be on another planet of gravitational acceleration **6.25 N/kg** given that acceleration due to gravity

on earth is **9.8N/kg** (2mks)

M =W/g = 8.0/9.8 = 0.8163kg

W = mg = 0.8163x6.25 = 5.102N

24. The graph in the figure below shows the variation of the weights W of various objects with their respective masses,



Use the graph to determine the gravitational field strength. (3 mks)

gravitational field strength = slope of the graph

$\frac{40-0}{4-0}$ *=10N/Kg*

