- Archimedes law is related **- law of flotation**
- When an object is fully or partially immersed in a liquid then its weight appears decreases and equal to the weight appears decreases and equal to the weight of the liquid displaced by that object. It is based on the principle of **-Archimedes Principle**
- The scientist related to buoyancy is **- Archimedes**
- A piece of iron should not float on the surface of the water is due to **- The weight of the mass displaced by it is less than iron ball.**
- Which country did the great scientist Archimedes belong. **-Greece**
- When a stone is brought from the surface of the moon to the earth, then **- Its weight will change but mass not change.**
- A person sitting in a lift feel his weight more when **-lift moving upward with uniform velocity**
- The tennis ball lands higher on a hill than on the field due to **- Earth's Gravitational acceleration on mountains gets less.**
- If the gravitational force of the earth suddenly vanishes, then **- The weight of the object will become zero, but the value remain the same.**
- Steel bullet floats in mercury because **-The density of mercury is higher than that of steel.**
- When a boat goes to sea from river then **- Rises slightly upward.**
- On changing the quantity of the object will remain unchanged **-Density**
- The wall below the dam is built thick because **-Pressure of liquid increases with increases in depth.**
- The distance covered by a body free fall is proportional to **- Square of time of fall**

PREVIOUS YEAR QUESTIONS

1. A 10 N force is applied on a body which produces in it an acceleration of 2 m/s^2. The mass of the body is

(a) 5 kg (b) 10 kg
(c) 15 kg (d) 20 kg

RRB ALP CBT II Physics & Maths 21 .01.2019 Shift III

Ans. (a) : Given, F = 10 Newton
Acceleration (a) = 2 m/s^2
The mass of the body = ?

$F = m \times a$
$10 = m \times 2$
$m = 5$ kg

2. If a force of 250 N acts on a body at rest, the momentum required is 125 kgm/s. The time for which the force acts on the body is

(a) 0.5 s (b) 0.2 s
(c) 0.1 s (d) 0.3 s

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Ans. (a) : Given that,
F = 250 N
Change in momentum = Impulse (ΔP) = 125 Kgm/s
Δt = ?

$\Delta P = F \times \Delta t$

$\Delta t = \frac{\Delta P}{F}$

$\Delta t = \frac{125}{250}$

Δt = 0.5 sec

3. Two spheres of masses m and M are situated in air and the gravitational force between them is F. The space between the masses is now filled with a liquid of specific gravity 3. The gravitational force will now be

(a) F/3 (b) F/9
(c) 3F (d) F

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Ans. (d) : Gravitational force is given by

$F = \frac{GMm}{R^2}$

Clearly the Gravitational force is dependent only on mass of objects and distances between them. It does not depend on any medium between them. Hence, the force will remain same i.e. F.

4. If three particles, each of mass M are placed at the three corners of an equilateral triangle of side a , the force exerted by this system on another particle of mass M placed at the midpoint of a side is

(a) $4GM^2/2a^2$ (b) $4GM^2/3a^2$
(c) $2GM^2/3a^2$ (d) $2GM^2/5a^2$

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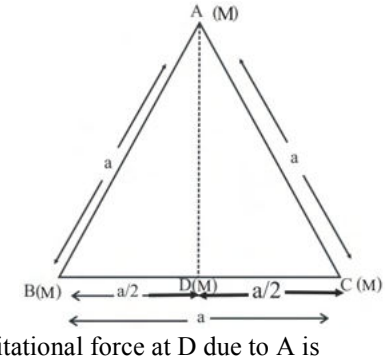
Ans. (b) : We know that,

$$\left[F = \frac{GM_1M_2}{R^2}\right]$$

According to Question-



The gravitational force at D due to A is

$F_{AD} = \frac{GMM}{AD^2}$

Now,
$AC^2 = AD^2 + DC^2$

$$(a)^2 = (AD)^2 + \left(\frac{a}{2}\right)^2$$

$$a^2 - \frac{a^2}{4} = AD^2$$

$$\boxed{\frac{3a^2}{4} = AD^2}$$

Then,

$$\boxed{F_{AD} = \frac{4GM^2}{3a^2}}$$

5. The quantity of motion of a body is best represented by

(a) Its velocity
(b) Its speed
(c) Its mass
(d) Its linear momentum

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Ans. (d) : $\Rightarrow$ The quantity of motion of a body is best represented by 'its linear momentum'.

$$\boxed{P = m \times V}$$

Where,

P = Momentum
m = Mass
V = Velocity

6. A spring when compressed by 4 cm has 2 J energy stored in it. The force required to extend it by 8 cm will be

(a) 2 N (b) 20 N
(c) 2000 N (d) 200 N

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Ans. (d) : Energy stored in a spring is given by,

$$E = \frac{1}{2}Kx^2$$

Where K is spring constant and x is compression/ expansion of spring

$$E = \frac{1}{2} \times K \times x^2$$

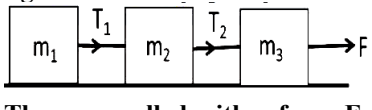
$$2 = \frac{1}{2} \times K \times 16 \times 10^{-4}$$

$$K = \frac{4}{16 \times 10^{-4}} = 2500\,N/m$$

Now force required to extend it by 8 cm is

$$F = Kx = 2500 \times 8 \times 10^{-2} \Rightarrow \boxed{F = 200N}$$

7. Three blocks of masses m_1 , m_2 and m_3 are connected by mass less strings as shown in figure on a frictionless table.



They are pulled with a force F = 40 N. If m_1 = 10 kg, m_2 = 6 kg and m_3 = 4 kg then tensions T_2 will be

(a) 20 N (b) 40 N
(c) 10 N (d) 32 N

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Ans. (d) : Given,

F = 40N
m_1 = 10 kg, m_2 = 6 kg, m_3 = 4 kg

We know that,

F = ma

Total mass of the system

$m = m_1 + m_2 + m_3$
$= 10 + 6 + 4$
$= 20$ kg

Then,

Total acceleration of the system

$40 = 20 \times a \Rightarrow \boxed{a = 2m/s^2}$

Now,

Tension T_2 will be,

$T_2 = (m_1 + m_2)\, a = (10+6) \times 2$
$T_2 = 16 \times 2$

$\Rightarrow \quad \boxed{T_2 = 32N}$

8. Which of the following force is conservative?

(a) Frictional force (b) Air resistance
(c) Electrostatic force (d) Viscous force

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Ans. (c) : A conservative force is one for which the work done is independent of path.
For example - Gravity force, Electrostatic force.
The electrostatic force is an attractive as well as repulsive force caused by the electric charge particles. It is also known as Coulomb's force.

9. A man weighs 'W' on the surface of earth and his weight at a height '2R' from surface of earth is (R is the Radius of earth).

(a) $\frac{w}{9}$ (b) $\frac{w}{6}$
(c) w (d) $\frac{w}{3}$

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Ans. (a) : $g = \frac{GM}{R^2}$ [given h = 2R]

$$g' = \frac{GM}{(R+h)^2}$$

$$g' = \frac{GM}{(R+2R)^2} = \frac{GM}{(3R)^2} = \frac{GM}{9R^2} = \frac{g}{9}$$

$w = mg$
$w' = mg'$

$$w' = \frac{mg}{9}$$

$$\boxed{w' = \frac{w}{9}}$$

10. A bullet of mass 0.05 kg is moving with a speed of 90 m/s and hits a heavy wooden block. The bullet enters the block and stops at a depth of 30 cm. Then the average force exerted by the wooden block on the bullet to resist the motion is

(a) 675 N (b) 150 N
(c) 250 N (d) 270 N

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Ans. (a) : Given that,

Mass(m) = 0.05 kg

Initial speed (u) = 90m/sec

Travelling distance (s) = 30 cm = $\frac{30}{100}$ m

Finally the bullet comes to rest after travelling some distance i.e. Final velocity (v) = 0

From 3rd equation of motion :

$v^2 - u^2 = 2as$

Put the value in above equation

$$0 - (90)^2 = \frac{2 \times a \times 30}{100}$$

$$-8100 = \frac{3a}{5}$$

$$a = \frac{-8100 \times 5}{3}$$

$a = -13500$ m/sec^2

Negative sign shows that it is retardation,

$a = 13500$ m/sec^2

Force = mass × acceleration

$= 0.05 \times 13500$

$= 675$N

11. Two wires, A and B, of same material and length are stretched by applying the same load. If the diameter of wire A is twice that of wire B, then the ratio of the extensions produced in the wires by applying the same load will be

(a) 1 : 2 (b) 2 : 1

(c) 1 : 4 (d) 1 : 1

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Ans. (c) : Given that,

Diameter of A = 2× diameter of B

Let diameter of B = d,

So,

diameter of A = 2d

Change in length $(\Delta\ell) = \frac{F.\ell}{\gamma.A}$

Where, F = Force or load

ℓ = original length

γ= Young's modules

A = cross section area

From the questions,

The force, original length (ℓ) and young's modulus is same for both wire.

So,

Change in length of wire A, $(\Delta\ell)_A = \frac{F.\ell}{\gamma.A}$

$(\Delta\ell)_B = \frac{F.\ell}{\gamma.A'}$

Area of wire $B_A(A') = \frac{\pi(2d)^2}{4}$

Area of wire A(A) = $\frac{\pi d^2}{4}$

Put the value of Area of wire A and B

So, $\frac{(\Delta\ell)_A}{(\Delta\ell)_B} = \frac{\frac{F\ell}{\gamma\frac{\pi}{4}(2d)^2}}{\frac{F.\ell}{\gamma\frac{\pi}{4}d^2}}$

ratio = $\frac{(\Delta\ell)_A}{(\Delta\ell)_B} = \frac{1}{4}$

12. Moment of inertia of a thin circular ring of mass M and R rotating about an axis, passing through its centre and perpendicular to the plane is

(a) MR^2 (b) $MR^2/4$

(c) $MR^2/2$ (d) $(2/5)\,MR^2$

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Ans. (a) : Given, the mass of the circulating ring is 'M' and radius 'R'.

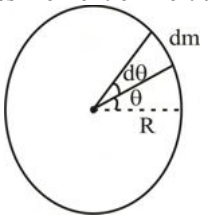
We take elementary unit section of the ring

$$dm = \frac{M}{2\pi R}$$

So, $dI = dm(R)^2$ $\quad \because I = mr^2$

$$dI = \frac{M}{2\pi R}.R^2$$

Integrating the mass moment of inertia



$$\int dI = \int \frac{M}{2\pi R}.R^2.dx$$

$$I = \frac{M}{2\pi}.R\int_0^{2\pi R} dx$$

$$= \frac{M}{2\pi}.R(2\pi R - 0)$$

$I = MR^2$

13. Which of the following will not exist for a liquid in a gravity – free space

(a) Viscosity (b) Surface tension

(c) Upward thrust (d) Pressure

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Ans. (c) :

Upward thrust is defined as the force that is exerted on an object by the fluid when the object is submerged. It is also called as buoyant force. It always acts upwards. It always acts against the weight of an object.

$F_{buoyant} = \rho \times g \times V$

Where, ρ = density of fluid

g = acceleration due to gravity

V = volume of fluid

In gravity free space,

$F_{buoyant} = 0$

That is upward thrust will not exist in a gravity free space.

Viscosity : The property of a fluid which opposes the relative motion between the layer is called viscosity.

Surface tension : It is a property of liquids characterized by the surface molecules tendency to shrink into a lower surface area as a result of bulk force from inner molecules.

$$\text{surface tension} = \frac{\text{force}}{\text{length}}$$

Pressure : Fluid pressure is a measurement of the force per unit area on an object in the fluid or on the surface of a closed container.

- Viscosity, surface tension and pressure does not depends on the gravity.

14. Two objects A and B of masses 4 kg and 6 kg are acted upon by the forces F_1 and F_2 required to accelerate them at 7 m/s^2 and 4 m/s^2 respectively. Which of the following relationships between the force F_1 and F_2 holds true for the required purpose?

(a) $F_1 > F_2$ only
(b) $F_1 = F_2$
(c) $F_1 < F_2$ or $F_1 > F_2$, depending on the mass density of the material of the objects.
(d) $F_1 < F_2$ only

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Ans. (a) : Given that,
Mass $(m_1) = 4$ kg
Mass $(m_2) = 6$ kg
Acceleration $(a_1) = 7$ m/sec^2
Acceleration $(a_2) = 4$m/sec^2
We know that,
Force (F) = Mass (m) × Acceleration (a)
So,

$F_1 = m_1 \times a_1$
$= 4 \times 7$
$= 28$ N
$F_2 = m_2 \times a_2$
$= 6 \times 4 = 24$N

Relationship between the force = $F_1 > F_2$.
So option (a) is correct.

15. Dirt can be removed from a carpet by shaking it vigorously for some time in process that is based on

(a) Second law of motion
(b) Both third and second laws of motion
(c) Third law of motion
(d) First law of motion

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Ans. (d) :

- Newton's first law of motion also known as the law of inertia. The property of inertia is the property of a body that causes it to tend to stay in a steady state of motion or at rest unless an external force is applied to the body.
- When a carpet is shaken with a stick the material of the carpet moves in forward and backward directions. The dust particles on the carpet tend to remain at rest due to their property of inertia. Since the dust particles get separated from the carpet because they are still at rest, they fall under the force of gravity. Thus it is based on the first law of motion.

16. What is the relative density of a solid of mass 50 gm which when fully immersed in water weighs 10 gm?

(a) 0.8 (b) 1.25
(c) 2.5 (d) 5

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Ans : (b)
Mass of solid = 50 gram
Decrease in weight of solid = 50-10 = 40 gram
density of water = 1 gm/cc
Volume of solid = 40 cc

$$\text{Hence, the density of solid} = \frac{\text{Mass}}{\text{Volume}} = \frac{50}{40} = 1.25 \text{ gm/cc}$$

$$\text{relative density} = \frac{\text{density of solid}}{\text{density of water}} = \frac{1.25}{1} = 1.25 \text{ gm/cc}$$

17. Find the length (in cm) of the edge of a cube of a piece of wood which weighs 80 N. (Use g = 10 m/s^2, density of wood = 1g/cm^3)

(a) 60 (b) 20
(c) 80 (d) 40

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Ans : (b) Let the side of cubical piece = a
Volume $= a^3$
Force = 80 N
g $= 10 m/s^2$
density $(\rho) = 1 g/cm^3 = 1000 kg/m^3$
Force $= m \times g$
$80 = m \times 10$
$m = 8$ kg

$$\text{density}(\rho) = \frac{\text{m (mass)}}{\text{v (volume)}}$$

$$1000 = \frac{8}{v}$$

$$V = \frac{8}{1000}$$

$$(a)^3 = \frac{8}{1000}$$

$$a = \frac{2}{10} m$$

$$a = \frac{2}{10} \times 100 \text{ cm}$$

$$\boxed{a = 20 \text{ cm}}$$

18. Find mass of an iron cube of side 2 cm. (Density of iron is 7.8 gm/cm^3)

(a) 15.6gm (b) 3.9gm
(c) 0.975gm (d) 62.4gm

RRB ALP & Tech. 23.01.2019 Shift-I

Ans : (d) Volume of iron cube $= 2 \times 2 \times 2$
$= 8$ cm^3
Mass of cube = volume × density
$= 8 \times 7.8$
$= 62.4$ gm

19. An object with greater———has greater inertia
(a) Acceleration (b) Mass
(c) Velocity (d) Volume

RRB ALP & Tech. 23.01.2019 Shift-I

Ans : (b) Inertia is depend on the mass of the object Hence, an object with greater mass has greater inertia.

20. Acceleration due to gravity on moon is 1/6th that on earth. How would an astronaut weigh on moon if he weight 90 kgf on earth? (acceleration due to gravity on earth = 10m/s^2)
(a) 9N (b) 90N
(c) 150N (d) J15

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Ans : (c) Mass (m) = 90 kg
acceleration due to gravity = 10 m/sec^2
Astronaut weight on earth,
$W = m \times g$
$= 90 \times 10$
$= 900$ N

$$\text{Weight on moon} = \frac{1}{6} \times \text{weight on earth}$$
$$= \frac{1}{6} \times 900$$
$$= 150 \text{ N}$$

21. Acceleration due to gravity on Jupiter is two and a half times that on earth. How much would a 250 kg satellite weight (in N) on Jupiter? (acceleration due to gravity on earth = 10m/s^2)
(a) 6250 (b) 10
(c) 625 (d) 100

RRB ALP & Tech. 23.01.2019 Shift-II

Ans : (a) Mass on earth (m) = 250 kg
Acceleration due to gravity (g) = 10 m/s^2
Weight on earth (w) = m × g
$= 250 \times 10$
$= 2500$ N

$$\text{Weight on Jupiter} = \frac{5}{2} \times 2500 = 6250 \text{ N}$$

22. A block of metal of mass 500 g has a relative density of 2.5. What will be its apparent mass when it is fully immersed in water?
(a) 250g (b) 300g
(c) 200g (d) 400g

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Ans : (b) Actual mass = 500
relative density = 2.5
apparent mass = ?

$$\text{Relative density} = \frac{\text{Actual mass}}{\text{Actual mas - appearant mass}}$$
$$2.5 = \frac{500}{500 - x}$$
$$2.5\,(500 - x) = 500$$
$$1250 - 2.5x = 500$$
$$2.5x = 1250 - 500$$
$$x = \frac{750}{2.5}$$
$$\boxed{x = 300\text{g}}$$

23. A uniform meter scale weights 50g. It is pivoted at the 70cm mark. Where should a 40 g mass be placed so that the scale is in equilibrium?
(a) At the 45 cm mark (b) At the 25 cm mark
(c) At the 95 cm mark (d) At the 5 cm mark

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Ans : (b) In equilibrium condition :-
$\sum m = 0$
$40 \times x = 20 \times 50$
$$x = \frac{20 \times 50}{40}$$
$x = 25$ cm

24. Find the mass (in kg) of a tank completely filled with kerosene of dimensions 5m × 2m × 1m (Density of kerosene is 800 kg/m^3)
(a) 8000 (b) 1250
(c) 800 (d) 12500

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Ans : (a) $\text{density} = \frac{\text{Mass}}{\text{Volume}}$
$\therefore$ mass = density × volume
mass of kerosene = 800 × 5 × 2 ×1 = 8000 kg

25. Acceleration due to gravity is highest at_____.
(a) the poles (b) the equator
(c) at an infinite distance from the earth
(d) the center of the earth

RRB ALP & Tech. 23.01.2019 Shift-II

Ans : (a) Acceleration due to gravity (g) is highest at the poles. As the distance decreases from the centre g decrease and vice – versa.

26. Find the density (in kg/m^3) of a piece of wood measuring 6cm×8cm×5cm and weighing 1.92N (g = 10m/sec^2)
(a) 3000 (b) 300
(c) 8000 (d) 800

RRB ALP & Tech. 23.01.2019 Shift-II

Ans : (d) Given that,
Volume (V) = 6 cm × 8 cm × 5 cm
$$= \frac{240}{1000000} = \frac{24}{100000} \text{m}^3$$
Weight (W) = 1.92 N
(g) = 10 m/s^2
$w = mg$
$1.92 = m \times 10$
$$m = \frac{1.92}{10}$$
$m = 0.192$ kg

$$\text{(density) (d)} = \frac{\text{mass(m)}}{\text{volume(v)}} = \frac{0.192}{\frac{24}{100000}}$$
$$\text{(d)} = \frac{0.192 \times 100000}{24} = \frac{19200}{24} = 800 \text{ kg/m}^3$$

27. Find the length of the edge of a metal cube of density 8 g/cm^3 which weight 17.28 kN. (Use g = 10 m/s^2)
(a) 9 cm (b) 8 cm
(c) 10 cm (d) 6 cm

RRB ALP & Tech. 08.02.2019 Shift-I

Ans : (d) : $\text{volume} = \frac{\text{mass}}{\text{density}}$

$\text{Volume of cube} = \frac{17.28\times10^3}{10\times8} = 216\text{cm}^3$

$\because$ Volume of cube $= a^3$ (a = side of cube)

$a^3 = 216\ \text{cm}^3$

$a = (216)^{\frac{1}{3}}\ \text{cm} = 6\ \text{cm}$

28. Two children of 24 kg and 16 kg sit on one side of a see-saw at a distance of 1 m and 0.625 m respectively, from the fulcrum. If a body of 'm' kg sits on the other side of the see-saw at a distance of 1.6 m from the fulcrum and the see-saw is in equilibrium. Find m.

(a) 21.25 kg (b) 32.25 kg
(c) 27.75 kg (d) 36.75 kg

RRB ALP & Tech. 08.02.2019 Shift-I

Ans : (a) : Since, the children of 24kg and 16kg are sitting on the one side and one child of mass 'm' is sitting on another side of mass 'm'. Therefore in equilibrium position -

$(24\times1) + (16\times0.625) = m\times1.6$

$24 + 10 = m \times 1.6$

$m = \frac{34}{1.6}$

$m = 21.25\ \text{kg}$

Hence, the weight of the child sitting on the other side will be 21.25kg.

29. The gravitational acceleration is _____m/s^2 at the equator.

(a) 9.87 (b) 9.72
(c) 9.78 (d) 9.83

RRB ALP & Tech. 08.02.2019 Shift-I

Ans : (c) : The acceleration due to gravity at the equator is 9.78 m/sec. The diameter of the earth at the equator is approximately 12,756 km. The equator divides the earth into the Northern Hemisphere and southern hemisphere.

30. Acceleration due to gravity on Mars is 1/3rd that on earth. How much would an astronaut weight on Mars if he weighs 72 kg on earth? (Acceleration due to gravity on earth = 10 m/s^2)

(a) 720 N (b) 240 N
(c) 120 N (d) 360 N

RRB ALP & Tech. 08.02.2019 Shift-I

Ans: (b) : Weight on earth $(W_1) = 72$ kg

Acceleration due to gravity $(g) = 10\ m/s^2$

Gravity on mars $(g) = g/3$

$= \frac{10}{3}\ m/s^2$

$g' = \frac{g}{3} = \frac{72}{3} = 24\ \text{kg}$

Weight on mars $= 24\times10 = 240$ N

31. What is the relative density of a solid of mass 75 gm which when fully immersed in water weighs 25 gm?

(a) 1.5 (b) 0.8
(c) 1.6 (d) 2.5

RRB ALP & Tech. 08.02.2019 Shift-I

Ans : (a) :

Weight of solid = 75 gm

Weight of solid on sinking = 25 gm

Amount of water displaced by solid (75-25) = 50 gm

$\text{relative density} = \frac{\text{mass of solid}}{\text{amount of water displaced by solid}}$

$= \frac{75}{50} = \frac{3}{2} = 1.5$

32. The effort done to shift a load is 15 units and the work done by the machine is 3. Then find the weight.

(a) 45unit (b) 3unit
(c) 5 unit (d) 15 unit

RRB ALP & Tech. 23.01.2019 Shift-III

Ans : (a) The effort done to shift a load is 15 units and the work done by the machine is 3 units. The weight will be 45 unit.

33. If the specific gravity of a body is less than 1, it will float on ___.

(a) Water (b) Liquid
(c) Mercury (d) Air

RRB ALP & Tech. 23.01.2019 Shift-III

Ans : (a) If specific gravity comes out to be less than one. It simply means that it is less than dense than water. Hence, it will float on water, And if the value is more than one, it means it is denser than water and it would sink in water.

34. The volume of a certain amount of water between 0°C to 4°C is ____.

(a) Increases (b) Decreases
(c) Remains constant (d) Zero

RRB ALP & Tech. 23.01.2019 Shift-III

Ans : (b) The density of water is highest at 4°C and the volume is least. The volume of water increase when is heated or cooled at a temperature higher or lower than 4°C. Thus, volume of given amount of water decrease between 0°C and 4°C while it increase above 4°C.

35. If a body is not homogeneous, then its density is a function of its ____.

(a) Pressure (b) Position
(c) acceleration (d) velocity

RRB ALP & Tech. 23.01.2019 Shift-III

Ans : (b) If a body is not homogeneous, then its density is a function of its position. The density of a substance is equal to mass per unit volume. The density of a homogeneous material is equal at all points on an object.

36. It is mainly due to the gravitational effect of the ____ on the rotating earth that the level of water in the sea rises and falls.

(a) Moon (b) Venus
(c) Mercury (d) Sun

RRB ALP & Tech. 23.01.2019 Shift-III

Ans : (a) The rise and fall of sea level is mainly due to the gravitational effect of the moon on the rotating earth.

37. An object weighs X units on the earth. If we take the same object to the moon, its weight there will be.....

(a) more than X (b) equal to X
(c) less than X (d) zero

RRB ALP & Tech. 23.01.2019 Shift-III

Ans : (c) The value of acceleration due to gravity on the moon is $\frac{1}{6}$ of the acceleration due to gravity on the earth. If the weight of the object is x unit on the earth than weight of the object on the moon is $\left(w = \frac{m \times g}{6}\right)$ decreases by $\frac{x}{6}$ unit. Hence, if we take the same object to the moon, its weight decrease.

38. A block of wood floats on water, with 65% of its volume under water. Its density (in kg/m^3) is approximately.

(a) 0.55×10^3 (b) 0.35×10^2
(c) 0.25×10^2 (d) 0.65×10^3

RRB ALP & Tech. 22.01.2019 Shift-I

Ans : (d) Total volume of wood = 100%
Volume of wood immersed in water = 65%
Density of water = 1000kg/m^3
Density of wood = x = ?

$$\frac{\text{Volume of wood immersed in water}}{\text{Total Volume of wood}} = \frac{\text{Density of wood}}{\text{density of water}}$$

$$\frac{65}{100} = \frac{x}{1000}$$

$x = 650$ kg/m^3
$x = 0.65 \times 10^3$ kg/m^3

39. The density of fresh water is_____ the density of salt water :

(a) less than (b) more than
(c) negligible compared with
(d) equal to

RRB ALP & Tech. 22.01.2019 Shift-I

Ans: (a) When salt is dissolved in fresh water the density of water increase due to the increase in the mass of the water therefore, the density, of fresh water is less than the density of salt water.

40. The mass density or density of a material is defined as its _____.

(a) mass per unit volume
(b) mass per unit length
(c) mass per unit area
(d) mass per ampere

RRB ALP & Tech. 22.01.2019 Shift-I

Ans : (a) $\text{Density} = \frac{\text{mass}}{\text{volume}}$
Density is scalar quantity. Unit of density is kg/m^3.

41. Let W_e and W_m be the weight of an object on the Earth and the Moon, respectively. Then, the ratio W_e/W_m is equal to _____.

(a) 2 (b) 1
(c) 6 (d) 4

RRB ALP & Tech. 22.01.2019 Shift-I

Ans : (c) Let, mass of object = m
Weight on earth surface = $W_e = m\times g$

Weight on moon surface = $W_m = m \times \frac{g}{6}$

$$\frac{W_e}{W_m} = \frac{m \times g}{m \times \frac{g}{6}}$$

$$\frac{W_e}{W_m} = 6$$

42. The relative density of gold is 19.3. Its density in SI unit is:

(a) 19.3 kg/m^3 (b) 19.3×10^3 kg/m^3
(c) 1.93×10^2 kg/m^3 (d) 19.3×10 kg/m^3

RRB ALP & Tech. 22.01.2019 Shift-II

Ans : (b) Relative density of gold = 19.3

$$\text{relative density} = \frac{\text{density of object}}{\text{density of water}}$$

density of gold = relative density × density of water gold.
$= 19.3\times1000$
$= 19300$ kg/m^3
$= 19.3\times10^3$ kg/m^3

43. If an object has a mass of 100 kg on Earth, what would be its mass on the Moon?

(a) 980 kg (b) 100 kg
(c) 0 kg (d) 16.7 kg

RRB ALP & Tech. 22.01.2019 Shift-II

Ans : (b) : If an object has a mass of 100 kg on earth, then its mass on the moon is 100 kg i.e. remains same.
Weight = mass × gravity
$\boxed{W = mg}$

44. The Ideal-gas equation is ____.

(a) P/VT = μR (b) T/PV = μR
(c) PV/T = μR (d) PV/T = (1/μ)R

RRB ALP & Tech. 22.01.2019 Shift-II

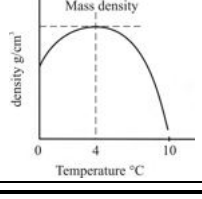
Ans : (c) : Ideal gas equation:-
PV = μRT _____ equ.(i).
Where,
P = atmospheric pressure
V = volume
μ = mole of the gas
R = Gas constant
T = Temperature
equ. (i) $\Rightarrow \frac{PV}{T} = \mu R$

45. Water has the maximum density at ___°C.

(a) 4 (b) 22
(c) 2 (d) 0

RRB ALP & Tech. 22.01.2019 Shift-II

Ans : (a) : Water has maximum density at 4°C. Graph between temperature and density:-



46. Consider a planet whose mass and radius both are one half to that of Earth. An object of weight W on Earth will weigh ____ on that planet.

(a) W/2 (b) 2W
(c) W/4 (d) W

RRB ALP & Tech. 22.01.2019 Shift-II

Ans : (d) : There will be no change in the mass of object. only the weight will change due to gravitational acceleration. The mass of the object remain unchanged.

47. A cubical block of side 10 cm and with a mass of 600 g floats in water. How much of the cube is submerged?

(a) 30% (b) 40%
(c) 60% (d) 50%

RRB ALP & Tech. 22.01.2019 Shift-II
RRB ALP & Tech. 22.01.2019 Shift-III

Ans : (c) : Side of cube = 10 cm

Volume of cube = $(10)^3 = 1000\ cm^3$

Mass of cube = 600 g = 0.6 kg

density of cube (d) = m/V

$$= \frac{600}{1000} = 0.6 g/cm^3$$

Percentage of immersed cube in water

$= 0.6 \times 100 = 60\%$

48. The actual weight of a person is determined by his:

(a) Mass and the acceleration due to gravity
(b) Mass
(c) Mass and width
(d) Mass and height

RRB ALP & Tech. 22.01.2019 Shift-II

Ans : (a) : The actual weight of a person is:-

Weight = mass of object × gravity

$\boxed{W = mg}$

49. The acceleration due to gravity on the Moon is (1/6) of that on the Earth. Hence, an object weighing 12 N on the Earth will weigh ..... on the Moon.

(a) 6 N (b) 72 N
(c) 2 N (d) 12 N

RRB ALP & Tech. 21.01.2019 Shift-I

Ans : (c) : Weight of body on the earth (W) = 12N

Weight of body on the moon

$$= \frac{1}{6} \times W$$

$$= \frac{1}{6} \times 12N$$

$= \boxed{2N}$

50. Identify the variable from below that does not describe the behaviour of a gas.

(a) Temperature (b) Volume
(c) Pressure (d) Time

RRB ALP & Tech. 21.01.2019 Shift-I

Ans : (d) : Ideal gas equation is –

PV = nRT

Where, P = atmospheric pressure

V = Volume

n = no. of moles

R = Gas constant

T = Temperature

Hence, time is not describe the behaviour of gas.

51. The density of an ideal gas can be doubled by halving the :

(a) Absolute temperature (b) Velocity
(c) Mass (d) Pressure

RRB ALP & Tech. 21.01.2019 Shift-I

Ans : (a) : From ideal gas equation :-

$$PV = nRT$$

$$P = \frac{n}{V}RT$$

$$P = \frac{\rho}{M}RT$$

$$\rho = \frac{MP}{RT} \quad \ldots\ldots (eq^n(i))$$

From eq^n (i), It is clear that the density of an ideal gas can be doubled by halving the temperature.

52. An object of a specific mass will weigh -

(a) more on earth than on the moon
(b) same on both earth and moon
(c) less on the earth than on the moon
(d) zero on the earth

RRB ALP & Tech. 22.01.2019 Shift-III

Ans : (a) We know that

$W = mg$ ... eq(i)

On the moon, $g' = \frac{g}{6}$ ...eq(ii)

From equation(i), it is clear that the weight is directly proportional to the acceleration due to gravity.

From equation (ii) and equation (i) it is clear that the weight on the surface of earth is more than that on the Moon's surface.

53. The density of ice is ———— compared to the density of water.

(a) Equal (b) Negligible
(c) Less (d) More

RRB ALP & Tech. 22.01.2019 Shift-III

Ans : (c) The density of ice is less compared to the density of water. Ice has low density than water because it has a cage like structure. In this structure, a lot of vacant spaces are left when water molecules linked in ice.

54. The mass of an object is a numerical measure of its ————.

(a) Velocity (b) Gravity
(c) Inertia (d) Acceleration

RRB ALP & Tech. 22.01.2019 Shift-III

Ans : (c) The tendency of an object to resist changes in its state of motion varies with mass is called inertia of an object, Inertia is basically a measure of the mass of the body.

55. The apparent mass of a piece of metal when fully immersed in water is 60 gm. If the relative density of this metal piece is 2.5, find its actual mass (in gm)?

(a) 300 (b) 40
(c) 400 (d) 100

RRB ALP & Tech. 21.01.2019 Shift-II

Ans : (d) : Given : relative density = 2.5
Apperant mass = 60 gram
Actual mass = x

$$\text{relative density} = \frac{\text{Actual Mass}}{\text{Actual Mass} - \text{Appearant Mass}}$$

$$2.5 = \frac{x}{x-60}$$
$$\frac{5}{2} = \frac{x}{x-60}$$
$$5x - 300 = 2x$$
$$3x = 300$$
$$x = 100 \text{ gram}$$

56. Find the volume (in cm^3) of a piece of metal of density 5000 kg/m^3 and which weights 10.8 N. (Use g = 10 m/s^2)
(a) 21.6 (b) 216
(c) 540 (d) 54

RRB ALP & Tech. 21.01.2019 Shift-II

Ans : (b) : Given : density (d) = 5000kg/m^3
Weight (W) = 10.8 N
Gravitation (g) = 10m/sec^2

$$W = mg$$
$$10.8 = m \times 10$$
$$m = \frac{108}{100} =$$
$$m = 1.08 \text{ kg}$$
$$d = \frac{m}{V}$$
$$V = \frac{m}{d} = \frac{1.08}{5000} m^3$$
$$V = \frac{1.08}{5000} \times 10^6 cm^3 \left[\because 1m = 100cm\right]$$
$$= 216 \text{ } cm^3$$

57. A body of mass 60 kg weight 222 N on Mars. What is the acceleration due to gravity (in m/s^2) on Mars?
(a) 4.9 (b) 13.32
(c) 19.8 (d) 3.7

RRB ALP & Tech. 21.01.2019 Shift-II

Ans : (d) : Given,
m = 60 kg
W = 222 N
g = ?
From W = mg

$$g = \frac{W}{m}$$
$$g = \frac{222}{60}$$
$$g = 3.7 m/sec^2$$

Hence, on the mars acceleration due to gravity will be 3.7m/sec^2.

58. The weight of the object appears on one pan of a faulty scale as W_1 and on the other pan as W_2. True weight of the object-
(a) (W_1+W_2) (b) $\frac{W_1 + W_2}{2}$
(c) $\sqrt{W_1 \times W_2}$ (d) $W_1 \times W_2$

RRB Asst. Loco Pilot/Technician (Ahmedabad)-2014

Ans. (c) : According to the question, it the weight of an object is W in one pan of an defective scale and W_2 on the other pan, then the correct weight of the object is equal to the geometrical mean of W_1 and W_2.
i.e

$$W = \sqrt{W_2 \times W_2}$$

59. On the placing of body successively in the pans of a faulty balance. whose sides are unequal, its weight appeared to be 6.4 grains and 10 grams. The correct weight of the body is –
(a) 10 gm (b) 14 gm
(c) 8.2 gm (d) 8 gm

RRB Asst. Loco Pilot/Technician (Ranchi)-2014

Ans. (d): Actual weight $= \sqrt{W_1 \times W_2}$
$= \sqrt{6.4 \times 10}$
$= 8$ gram.

60. A wooden plank can rotate on a horizontal axis fixed in the middle. A child of mass 20 kg sits on one side the axis at a distance of 1.5m from the axis and on the other side another child of weight 16 kg sits at a distance of 2.0 m from the axis, then which boy will rise.
(a) 20 kg-weight (b) 16 kg-weight
(c) None of these (d) both (a) and (b)

RRB Asst. Loco Pilot/Technician (Kolkata)-2014

Ans. (a) : The child whose torque is less about the middle point of the frame will rise up. the torque of the 20W boy is 20 × 1.5, less then the torque (16 × 2 = 32) of the 16 W boy. therefore, 20W boy will rise up.

61. In comparison to the measurement of the surface of the Earth, those on top of Mr. Everest demonstrate :
(a) decrease in weight with mass remaining the same
(b) increase in the mass with weight remaining the same
(c) decrease in both mass and weight
(d) increase in both mass and weight

RRB SSE Secundrabad (Shift-I), 01.09.2015

Ans. (a) : The mass of a system is always a constant, i.e same in each case but the value of g decrease on going above or below the surface of the earth. The weight of an object always depends on the acceleration due to gravity (g). Hence the weight of the object decrease at the height but mass remains the same.

62. If two liquids of same mass and densities D_1 and D_2 are mixed then density of mixture-
(a) $\frac{D_1 + D_2}{2}$ (b) $\frac{D_1 D_2}{D_1 + D_2}$
(c) $\frac{2D_1 D_2}{D_1 + D_2}$ (d) $\frac{D_1 + D_2}{D_1 D_2}$

RRB Kolkata Chemical & Metallurgical Er., 01.12.2002

Ans. (c) : Density of mixture (D) = $\frac{\text{Total mass(m)}}{\text{total volume(V)}}$

$$= \frac{\text{m+m}}{\frac{\text{m}}{D_1}+\frac{m}{D_2}}$$

$$\text{D} = \frac{2D_1D_2}{D_1+D_2}$$

63. The mass of an object is 100kg. If acceleration due to gravity on the moon is $\frac{1}{6}$ then mass of an object on the surface of the moon will be –

(a) 100/6 kg (b) 60 kg
(c) 100 kg (d) 600 kg

RRB Bangalore Section Engineer (Civil) 01.02.2009

Ans. (c) Mass always remains constant. Therefore the mass on the moon will be only 100 kg.

64. It is easier to swim in the sea than in the river because –

(a) Sea water is deep
(b) Density of sea
(c) Water keep rising in the ocean
(d) The density of water in the sea is less

DMRC Mechanical Engineering, 18.02.2017

Ans. (b) : It is easier to swim in the sea than in the river because the density of sea water is more in comparison to river.

65. The weight of an object is maximum

(a) on the equator
(b) on the surface of the earth
(c) at the centre of the earth
(d) on the poles of the earth

RRB Chandigarh Section Engineer (Civil), 26.02.2012

Ans. (d) : The weight of a body is maximum at the poles of the earth because the value of acceleration due to gravity is maximum at the poles while the weight of the body at the equator is minimum. The weight of the object at the centre of the earth is zero.

66. The weight of a body at the centre of earth is:

(a) half the weight at the surface
(b) infinite
(c) twice the weight at the surface
(d) zero

RRB Chandigarh Section Engineer (Mech.), 26.02.2012

Ans. (d) The weight of the object at the centre of the earth is zero because the value of accretion due to gravity is zero.

at centre $h = R_e$

$g' = 0$

The acceleration due to gravity at any depth is given as –

$$g_d = g\left(1-\frac{d}{R}\right)$$

Where, g_d = acceleration due to gravity at some depth.

d = depth from its surface.

at centre d = R

$$\boxed{g_d = 0}$$

$W = mg_d$

$$\boxed{W = 0}$$

67. The relative density of ice is 0.9 then what part of it will be above the water when it is put in water?

(a) 0.9 (b) 0.1
(c) zero (d) None of these

DMRC Electronics Engineering, 21.09.2014

Ans. (b) : Let volume of cube = $(1\times1\times1)\ cm^3$

relative density of ice = 0.9

$$\frac{\rho_{ice}}{\rho_w} = \frac{x}{h}$$

$$\frac{0.9}{1} = \frac{x}{1}$$

$x = 0.9$ cm

Therefore, 0.9 part of ice under the water and 0.1 cm part of ice above the water.

68. The weight of body in air is 30g and when immersed in water is 26.25g. The relative density of the material of the body is –

(a) $\frac{8}{9}$ (b) $\frac{8}{7}$
(c) 8 (d) $8g/cm^3$

RRB Ranchi Signal Maintainer Group-III, 20.11.2005

Ans. (c) :

Relative density of substance = $\frac{\text{Wair}}{W_{air} - W_{water}}$

$$= \frac{30}{(30-26.25)}$$

$$= \frac{30}{3.75}$$

$= 8$

69. Two liquids which are equal to weight, are mixed, their density are ρ_1 and ρ_2 respectively. The density of mixture will be -

(a) $\frac{\rho_1+\rho_2}{2}$ (b) $\frac{2\rho_1\rho_2}{\rho_1+\rho_2}$
(c) $\frac{\rho_1+\rho_2}{\rho_1\rho_2}$ (d) $\frac{\rho_2-\rho_1}{2}$

RRB Allahabad Signal Maintainer-II, 22.01.2006

Ans. (b) : Let, weight of the liquids are W and volume are V_1 and V_2.

$$\text{density of mixture} = \frac{\text{total mass of maxture}}{\text{total volume of mixture}}$$

$$\frac{(M_1+M_2)}{(V_1+V_2)} = \frac{2M}{\frac{M}{\rho_1}+\frac{M}{\rho_2}} \left\{\because W_1 = W_2 = W \right\} \left\{\therefore M_1 = M_2 = M\right\}$$

$$= \frac{2}{\frac{1}{\rho_1}+\frac{1}{\rho_2}} = \frac{2}{\frac{\rho_1+\rho_1}{\rho_1\rho_2}}$$

$$\boxed{\text{Density of mixture} = \frac{2\rho_1\rho_2}{\rho_1+\rho_2}}$$

70. A vessel has, mercury (density =13.6 g/cm^3) at the bottom and oil (density 0.8 g/cm^3) at the top. Half of the volume of a floating homogeneous sphere is immersed in mercury and half, in oil. The density (g/cm^3) of the material of the sphere.

(a) 3.3 (b) 6.4 (c) 7.2 (d) 12.8

Delhi Metro Rail Corporation Train Operators', 14.09.2003

Ans. (c) : Density of substance of sphere $= \frac{\rho_{Hg} + \rho_{oil}}{2}$

$= \frac{(13.6 + 0.81)}{2}$

$= \frac{14.4}{2} = 7.2$

71. The reading of spring balance when a block of air is suspended from it is 60 N. When the block is immersed in less volume in water. The reading of a balance changes to 40 N – the relative density of the block should be -

(a) 3 (b) 2 (c) 6 (d) $\frac{3}{2}$

RRB Bangalore Material Superintendent, 21.11.2004

Ans. (a) : Relative density of block $= \frac{W_{air}}{W_{air} - W_{water}}$

$= \frac{60}{(60-40)}$

$= \frac{60}{20} = 3$

72. A vessel is filled with oil of relative density 1.2 up to a height of 3cm and water is filled up to 10 cm above it. If the relative density of mercury is 13.6 then the bottom of the vessel will be.

(a) Equal to 1 cm of Hg (b) Equal to 5 cm of Hg
(c) Equal to 13cm of Hg
(d) Equal to 15 cm of Hg.

RRB Trivandrum (Tech.), 09.11.1997

Ans. (a) : According to the question-

$\rho_{Hg}\, gh = \rho_{oil}\, gh_1 + \rho_{water}\, gh_2$

$13.6 \times gh = 1.2 \times g \times 3 + 1 \times g \times 10$

$13.6\, h = 3.6 + 10$

$h = \frac{13.6}{13.6}$

$h = 1$ cm of Hg.

73. Among four substance M_1, M_2, M_3 and M_4 of different masses having the same volume. Which substance will have the least density If $M_2 > M_3 > M_1 > M_4$ then.

(a) M_1 (b) M_3 (c) M_4 (d) M_2

RRB Trivandrum (Tech.), 11.04.1999

Ans. (c): By formula, density $= \frac{\text{mass}}{\text{volume}}$

According to the question, given that $M_2 > M_3 > M_1 > M_4$ and volume is constant and by the formula M_4 has least density

74. If the volume of four bodies of equal mass are V_1, V_2, V_3 and V_4 respectively then which body will have greater density if $V_4 > V_2 > V_3 > V_1$ then

(a) V_2 (b) V_3
(c) V_1 (d) V_4

RRB Trivandrum (Tech.), 29.06.1999

Ans. (c) : By the formula-

$\text{density} = \frac{\text{mass}}{\text{volume}}$ .....(i)

(Mass is same for all bodies)

According to the equation (i), which body has less volume, has more density.

Hence, V_1 has density. (given: $V_4 > V_2 > V_3 > V_1$)

75. What is density. of solid metals when hearted

(a) Increases (b) Decreases
(c) Equal (d) None of these

RRB Kolkata (Tech.), 29.08.1999

Ans. (b) : When metals are heated, they expand due to which volume increase but mass remains constant by formula-

$\text{density} = \frac{\text{mass}}{\text{volume}}$

therefore, when metals are heated, their density decrease.

76. Generally, the density of any liquid increases with increases temperature -

(a) decrease (b) increase
(c) remains constant
(d) first increase and then decreases

RRB Kolkata Supervisor (P. Way), 20.02.2000

Ans. (a) : Generally, the density of a liquid decrease with increase in temperature. Because by increasing the temperature the volume of a liquid increase. But the mass remains constant.

77. Whose density will be higher in the same quantity of viscous (thick) liquid and non-viscous liquid.

(a) viscous (b) non-viscous liquid
(c) None (d) both (a) and (b)

RRB Mumbai Electrical/ Diesel Drivers', 03.06.2001

Ans. (a) : If the quantity of thick (viscous) and non-viscous liquid are equal then the no. of molecules in the viscous liquid will be more than the no. of molecules in the non-viscous liquid. Hence, the mass of the viscous (thick) liquid will also be more. The density will be higher than that of a viscous liquid.

78. A body of a substance whose density is d is immersed in a liquid of density &, which completely sinks then -

(a) $d > \rho$ (b) $\rho > d$
(c) $d = \rho$ (d) None of these

RRB Bhopal Section Engineer, 24.11.2002

Ans. (a) : If a body made of a substance is placed in a liquid and the body is completely submerged then the density of the body is greater than the density of the liquid. So, $d > \rho$