

10th Science Lesson 1 Questions in English**1) Laws of Motion**

1. Which of the following statement is correct?

- 1) Some bodies are at rest and some are in motion.
 - 2) Things around us are related to one another
 - 3) There are various types of motion such as linear motion, circular motion, oscillatory motion, and so on
- a) 1, 2
 - b) 1, 3
 - c) 2, 3
 - d) **All the above**

Explanation

Things around us are related to one another. **Some bodies are at rest and some are in motion. Rest and motion are interrelated terms.** There are various types of motion such as **linear motion, circular motion, oscillatory motion**, and so on.

2. Who proposed the laws of motion?

- a) Edison
- b) **Newton**
- c) Aristotle
- d) All the above

Explanation

Let us define force in a more scientific manner using the **three laws proposed by Sir Isaac Newton**. These laws help you to understand the motion of a body and also to predict the future course of its motion, if you know the forces acting on it. Before Newton formulated his three laws of motion, a different perception about the force and motion of bodies prevailed.

3. Which of the following statement is correct?

- 1) Mechanics is the branch of physics that deals with the effect of force on bodies
 - 2) It is divided into two branches, namely, statics and dynamics.
- a) 1 alone
 - b) 2 alone
 - c) **1, 2**
 - d) None

Explanation

Mechanics is the branch of physics that deals with **the effect of force on bodies**. It is divided into **two branches, namely, statics and dynamics**.

4. _____ deals with the motion of bodies considering the cause of motion.

- a) Statics
- b) Kinematics
- c) **Kinetics**
- d) All the above

Explanation

Kinetics deals with the motion of bodies considering the cause of motion. Kinematics deals with the motion of bodies without considering the cause of motion.

5. _____ is rest under the action of forces.

- a) Kinetics
- b) Kinematics
- c) **Statics**
- d) Dynamics

Explanation

Statics deals with the bodies, which are at rest under the action of forces. Dynamics is the study of moving bodies under the action of forces. Dynamics is further divided into Kinematics and Kinetics.

6. According to _____ the natural state of earthly bodies is 'rest'

- a) Edison
- b) **Aristotle**
- c) Galileo
- d) Einstein

Explanation

According to **Aristotle a Greek Philosopher and Scientist, the natural state of earthly bodies is 'rest'.** He stated that a moving body naturally comes to rest without any external influence of the force. Such motions are termed as '**natural motion**' (**Force independent**).

7. Which of the following statement about Aristotle is correct?

- 1) Aristotle proposed that a force (a push or a pull) is needed to make the bodies to move from their natural state (rest)
 - 2) Violent motion is force independent
 - 3) He said, when two different mass bodies are dropped from a height, the lighter body falls faster than the heavier one.
- a) **1, 2**
 - b) 1, 3
 - c) 2, 3
 - d) All the above

Explanation

Aristotle proposed that a force (a push or a pull) is needed to make the bodies to move from their natural state (rest) and behave contrary to their own natural state called as '**violent motion**' (**Force**

dependent). Further, he said, **when two different mass bodies are dropped from a height, the heavier body falls faster than the lighter one.**

8. Which of the following concepts were proposed by Galileo?

- 1) The natural state of all earthly bodies is either the state of rest or the state of uniform motion
- 2) A body in motion will continue to be in the same state of motion as long as no external force is applied
- 3) When dropped from a height in vacuum, bodies of different size, shape and mass fall at the same rate and reach the ground at the same time.
 - a) 1, 2
 - b) 1, 3
 - c) 2, 3
 - d) **All the above**

Explanation

Galileo proposed the following concepts about force, motion and inertia of bodies:

- The natural state of all earthly bodies is either the state of rest or the state of uniform motion.
- A body in motion will continue to be in the same state of motion as long as no external force is applied.
- When dropped from a height in vacuum, bodies of different size, shape and mass fall at the same rate and reach the ground at the same time.

9. The resistance applied by body to change in state is called as_____

- a) **Inertia**
- b) Violent motion
- c) Gravity
- d) None

Explanation

When a force is applied on bodies, they resist any change in their state. This **property of bodies is called 'inertia'.**

10. Assertion(A): While you are travelling in a bus or in a car, when a sudden brake is applied, the upper part of your body leans in the forward direction

Reason(R): Anybody would like to continue to be in its state of rest or the state of motion. This is known as 'inertia'.

- a) Both (A) and (R) are correct, but (R) does not explain (A)
- b) Both (A) and (R) are wrong
- c) **Both (A) and (R) are correct and (R) explains (A)**
- d) (A) is Correct and (R) is wrong

Explanation

While you are travelling in a bus or in a car, when a sudden brake is applied, the upper part of your body leans in the forward direction. Similarly, when the vehicle suddenly is move forward from

rest, you lean backward. This is due to, anybody would like to continue to be in its state of rest or the state of motion. This is known as 'inertia'. The **inherent property of a body to resist any change in its state of rest or the state of uniform motion, unless it is influenced upon by an external unbalanced force, is known as 'inertia'.**

11. How many types of inertia are there?

- a) 4
- b) 3**
- c) 5
- d) 2

Explanation

There are **three types of inertia**. They are Inertia of rest, Inertia of motion, Inertia of direction.

- a) Inertia of rest: The resistance of a body to change its state of rest is called inertia of rest.
- b) Inertia of motion: The resistance of a body to change its state of motion is called inertia of motion.
- c) Inertia of direction: The resistance of a body to change its direction of motion is called inertia of direction

12. Take a glass tumbler and place a small cardboard on it. Then, flick the cardboard quickly. The cardboard falls off the ground and the coin falls into the glass tumbler. This happens due to__

- a) Inertia of motion
- b) Inertia of rest**
- c) Inertia of direction
- d) None

Explanation

In activity described above, the inertia of the coin keeps it in the state of rest when the cardboard moves. Then, when the cardboard has moved, the coin falls into the tumbler due to gravity. This **happens due to 'inertia of rest'.**

13. Match the following:

- | | |
|--------------------------|---|
| I. Inertia of motion | 1. A sharp turn while driving a car |
| II. Inertia of direction | 2. An athlete runs some distance before jumping |
| III. Inertia of rest | 3. While vigorously shake the branches of a tree, some of the leaves and fruits are detached and they fall down |
| a) 3, 1, 2 | |
| b) 1, 3, 2 | |
| c) 2, 1, 3 | |
| d) 2, 3, 1 | |

Explanation

- An athlete runs some distance before jumping. Because, this will help him jump longer and higher. (**Inertia of motion**)

- When you make a sharp turn while driving a car, you tend to lean sideways, (**Inertia of direction**).
- When you vigorously shake the branches of a tree, some of the leaves and fruits are detached and they fall down, (**Inertia of rest**).

14. Which of the following results in increased impact of force?

- 1) If velocity is more
 - 2) If mass of the body is more
 - 3) If velocity is less
 - 4) If mass is less
- a) 1, 4
 - b) 2, 3
 - c) 1, 2
 - d) None

Explanation

The **impact of a force is more if the velocity and the mass of the body is more**. To quantify the impact of a force exactly, a new physical quantity known as linear momentum is defined.

15. The product of mass and velocity of a moving body gives_____

- a) **Magnitude of linear momentum**
- b) Magnitude of circular momentum
- c) Acceleration
- d) Deceleration

Explanation

The **product of mass and velocity of a moving body gives the magnitude of linear momentum**. It acts in the direction of the velocity of the object.

Linear Momentum = mass $\times$ velocity

16. Which of the following statement is correct about Linear momentum?

- 1) It is Scalar quantity
 - 2) It helps to measure the magnitude of a force
 - 3) Unit of momentum in SI system is kg m s^{-1}
- a) 1, 2
 - b) 1, 3
 - c) 2, 3
 - d) All the above

Explanation

Linear momentum is a **vector quantity**. It helps to measure the magnitude of a force. Unit of momentum in SI system is kg m s^{-1} and in C.G.S system its unit is g cm s^{-1} .

17. Which law gives the definition of force as well as inertia?

- a) Newton's 1st law
- b) Newton's 2nd law
- c) Newton's 3rd law
- d) None

Explanation

Newton's First Law states that every - body continues to be in its state of rest or the state of uniform motion along a straight line unless it is acted upon by some external force. **It gives the definition of force as well as inertia.**

18. Which of the following statement about force is correct?

- 1) Force has both magnitude and direction
 - 2) It is a vector quantity
 - 3) It produces or tries to produce the motion of a static body.
- a) 1, 2
 - b) 1, 3
 - c) 2, 3
 - d) All the above

Explanation

Force is an external effort in the form of push or pull, which:

- 1. **produces or tries to produce the motion of a static body.**
- 2. stops or tries to stop a moving body.
- 3. changes or tries to change the direction of motion of a moving body.

Force has both magnitude and direction. So, it is a vector quantity.

19. Which of the following statement is correct?

- 1) Based on the direction in which the forces act, they can be classified into two types
 - 2) Two or more forces of equal or unequal magnitude acting along the same direction, parallel to each other are called like parallel forces.
 - 3) If two or more equal forces or unequal forces act along opposite directions parallel to each other, then they are called unlike parallel forces.
- a) 1, 2
 - b) 1, 3
 - c) 2, 3
 - d) All the above

Explanation

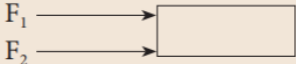
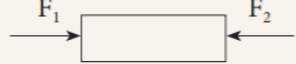
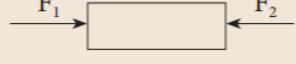
Based on the direction in which the forces act, they can be classified into two types as: (a) Like parallel forces and (b) Unlike parallel forces.

- Like parallel forces: Two or more forces of equal or unequal magnitude acting along the same direction, parallel to each other are called like parallel forces.
- Unlike parallel forces: If two or more equal forces or unequal forces act along opposite directions parallel to each other, then they are called unlike parallel forces.

20. Match the following:

- | | |
|---|---|
| I. Parallel forces are acting in the same direction | 1. $F_{\text{net}} = F_1 + F_2$ |
| II. Parallel unequal forces are acting in opposite directions | 2. $F_{\text{net}} = 0$ |
| III. Parallel equal forces are acting in opposite directions in the same line of action | 3. F_{net} is directed along the greater force |
- a) 3, 1, 2
b) 1, 3, 2
c) 1, 2, 3
d) 2, 1, 3

Explanation

Action of forces	Diagram	Resultant force (F_{net})
Parallel forces are acting in the same direction		$F_{\text{net}} = F_1 + F_2$
Parallel unequal forces are acting in opposite directions		$F_{\text{net}} = F_1 - F_2$ (if $F_1 > F_2$) $F_{\text{net}} = F_2 - F_1$ (if $F_2 > F_1$) F_{net} is directed along the greater force.
Parallel equal forces are acting in opposite directions in the same line of action ($F_1 = F_2$)		$F_{\text{net}} = F_1 - F_2$ ($F_1 = F_2$) $F_{\text{net}} = 0$

21. Which of the following statement is correct?

- When several forces act simultaneously on the same body, then the combined effect of the multiple forces can be represented by a single force, which is termed as 'resultant force'
 - It is equal to the vector sum (adding the magnitude of the forces with their direction) of all the forces
 - Drawing water from a well is an example of balanced force
- a) 1, 2
b) 1, 3
c) 2, 3
d) All the above

Explanation

When several forces act simultaneously on the same body, then the combined effect of the multiple forces can be represented by a single force, which is termed as 'resultant force'. It is equal to the vector sum (adding the magnitude of the forces with their direction) of all the forces. If the resultant force of all the forces acting on a body is equal to zero, then the body will be in equilibrium. Such forces are called balanced forces. If the resultant force is not equal to zero, then it causes the motion of the body due to **unbalanced forces**. Examples: **Drawing water from a well**, force applied with a crow bar, forces on a weight balance, etc.

22. The force used to bring system to equilibrium is called as_____

- a) Mediant
- b) Equilibrant**
- c) Unbalanced force
- d) Balanced force

Explanation

A system can be brought to equilibrium by applying another force, which is equal to the resultant force in magnitude, but opposite in direction. Such force is called as 'Equilibrant'.

23. Assertion(A): The door can be easily opened or closed when you apply the force at a point far away from the fixed edge

Reason(R): This turning effect of the applied force is more when the distance between the fixed edge and the point of application of force is more

- a) Both (A) and (R) are correct, but (R) does not explain (A)
- b) Both (A) and (R) are wrong
- c) Both (A) and (R) are correct and (R) explains (A)**
- d) (A) is Correct and (R) is wrong

Explanation

The door can be easily opened or closed when you apply the force at a point far away from the fixed edge. In this case, the effect of the force you apply is to turn the door about the fixed edge. This turning effect of the applied force is more when the distance between the fixed edge and the point of application of force is more.

24. The rotating or turning effect of a force about a fixed point or fixed axis is called_____

- a) Inertia
- b) Torque**
- c) Momentum
- d) None

Explanation

The rotating or turning effect of a force about a fixed point or fixed axis is called moment of the force about that point or torque (τ).

25. Torque is equal to_____

- a) Force (F) X perpendicular distance (d)**
- b) Force / perpendicular distance
- c) Mass X velocity
- d) Mass / velocity

Explanation

Torque is measured by the product of the force (F) and the perpendicular distance (d) between the fixed point or the fixed axis and the line of action of the force. $\tau = F \times d$

26. Which of the following statement about Torque is correct?

- 1) Torque is a vector quantity
 - 2) It is acting along the direction, perpendicular to the plane containing the line of action
 - 3) Its SI unit is N/m
- a) 1, 2
 - b) 1, 3
 - c) 2, 3
 - d) All the above

Explanation

Torque is a vector quantity. It is acting along the direction, perpendicular to the plane containing the line of action of force and the distance. Its **SI unit is N m**.

27. Which of the following statement is correct?

- 1) Two equal and unlike parallel forces applied simultaneously at two distinct points constitute a couple
 - 2) Rotating effect of a couple is known as moment of a couple.
 - 3) It does not produce any translatory motion since the resultant is zero
- a) 1, 2
 - b) 1, 3
 - c) 2, 3
 - d) All the above

Explanation

Two equal and unlike parallel forces applied simultaneously at two distinct points constitute a couple. The line of action of the two forces does not coincide. It does not produce any translatory motion since the resultant is zero. But, a couple results in causes the rotation of the body. **Rotating effect of a couple is known as moment of a couple.**

28. What is the CGS unit of moment of Couple?

- a) N m
- b) N
- c) **dyne cm**
- d) dyne

Explanation

Moment of a couple is measured by the product of any one of the forces and the perpendicular distance between the line of action of two forces. The turning effect of a couple is measured by the magnitude of its moment. $M = F \times S$

The unit of moment of a couple is newton metre (N m) in SI system and **dyne cm in CGS system**.

29. By convention, the direction of moment of a force is taken as___ if the body is rotated in the___ direction

- a) Positive, Clockwise
- b) Negative, Anti-Clockwise
- c) **Positive, Anti-clockwise**
- d) Negative, Clockwise

Explanation

By convention, the direction of moment of a force or couple is taken as **positive if the body is rotated in the anti-clockwise direction** and negative if it is rotate in the clockwise direction.

30. In which of the following involves the Application of Torque?

- 1) Gears
 - 2) Sea-saw
 - 3) Steering Wheel
- a) 1, 2
 - b) 1, 3
 - c) 2, 3
 - d) **All the above**

Explanation

Application of Torque:

- A gear is a circular wheel with teeth around its rim. It helps to change the speed of rotation of a wheel by changing the torque and helps to transmit power.
- Most of you have played on the sea-saw. Since there is a difference in the weight of the persons sitting on it, the heavier person lifts the lighter person. When the heavier person comes closer to the pivot point (fulcrum) the distance of the line of action of the force decreases. It causes less amount of torque to act on it. This enables the lighter person to lift the heavier person.
- A small steering wheel enables you to manoeuvre a car easily by transferring a torque to the wheels with less effort.

31. Which of the following statement regarding Principle of Moments is correct?

- 1) When a number of like or unlike parallel forces act on a rigid body and the body is in equilibrium, then the algebraic sum of the moments in the clockwise direction is equal to the algebraic sum of the moments in the anticlockwise direction.
 - 2) The algebraic sum of the moments of all the individual forces about any point is equal to positive.
- a) **1 alone**
 - b) 2 alone
 - c) 1, 2
 - d) None

Explanation

When a number of like or unlike parallel forces act on a rigid body and the body is in equilibrium, then the algebraic sum of the moments in the clockwise direction is equal to the algebraic sum of

the moments in the anticlockwise direction. In other words, at equilibrium, the **algebraic sum of the moments of all the individual forces about any point is equal to zero.**

32. Which law helps us to measure the amount of force?

- a) Newton's 1st law
- b) Newton's 2nd law**
- c) Newton's 3rd law
- d) None

Explanation

According to **Newton's Second law**, "the force acting on a body is directly proportional to the rate of change of linear momentum of the body and the change in momentum takes place in the direction of the force". **This law helps us to measure the amount of force.** So, it is also called as 'law of force'

33. Which of the following statement is correct?

- 1) Force $\propto$ rate of change of momentum
- 2) $F \propto$ change in momentum
- 3) F inversely proportionally to time
- a) 1, 2
- b) 1, 3
- c) 2, 3
- d) All the above**

Explanation

Force, $F \propto$ rate of change of momentum

$F \propto$ change in momentum / time

$$F \propto \frac{mv - mu}{t}$$

$$F = \frac{km(v - u)}{t}$$

$$F = \frac{m(v - u)}{t}$$

Here, k is the proportionality constant.

k = 1 in all systems of units. Hence,

$$F = \frac{m(v - u)}{t}$$

Since, acceleration = change in velocity / time, $a = (v - u) / t$. Hence, we have

$$F = m \times a \quad (1.3)$$

Force = mass $\times$ acceleration

34. Which of the following statement is correct?

- 1) Force is required to produce the acceleration of a body
 - 2) In a uniform circular motion, even though the speed (magnitude of velocity) remains constant, the direction of the velocity changes at every point on the circular path
 - 3) The force, which produces this acceleration is called as centrifugal force
- a) 1, 2
 - b) 1, 3
 - c) 2, 3
 - d) All the above

Explanation

Force is required to produce the acceleration of a body. In a uniform circular motion, even though the speed (magnitude of velocity) remains constant, the direction of the velocity changes at every point on the circular path. So, the acceleration is produced along the radius called as centripetal acceleration. **The force, which produces this acceleration is called as centripetal force**

35. What is the CGS unit of Force?

- a) Newton
- b) **dyne**
- c) Kg m s
- d) Kg m s⁻¹

Explanation

Units of force: SI unit of force is newton (N) and in C.G.S system its unit is dyne. Definition of 1 newton (N): The amount of force required for a body of mass 1 kg produces an acceleration of 1 m s⁻², 1 N = 1 kg m s⁻².

36. 1 Newton =

- a) 10³ dyne
- b) **10⁵ dyne**
- c) 10² dyne
- d) 10⁷ dyne

Explanation

The amount of force required for a body of mass 1 gram produces an acceleration of 1 cm s⁻², 1 dyne = 1 g cm s⁻²; also **1 N = 10⁵ dyne**.

37. A large force acting for a very short interval of time is called_____

- a) Inertia
- b) **Impulse**
- c) Couple
- d) None

Explanation

A large force acting for a very short interval of time is called as 'Impulsive force'. When a force F acts on a body for a period of time t , then the product of force and time is known as 'impulse' represented by 'J'

Impulse, $J = F \times t$

38. What is the unit of Impulse?

- a) Newton
- b) **N s**
- c) N m
- d) dyne

Explanation

Impulse, $J = F \times t$

By Newton's second law $F = \Delta p / t$ (Δ refers to change),

$\Delta p = F \times t$

Impulse is also equal to the magnitude of change in momentum. **Its unit is kg m s^{-1} or N s.**

39. Assertion(A): Automobiles are fitted with springs and shock absorbers to reduce jerks while moving on uneven roads

Reason(R): A smaller force acting for a longer period of time is one of the change in Momentum.

- a) **Both (A) and (R) are correct, but (R) does not explain (A)**
- b) Both (A) and (R) are wrong
- c) Both (A) and (R) are correct and (R) explains (A)
- d) (A) is Correct and (R) is wrong

Explanation

Given amount of change in momentum can be achieved in two ways. They are:

- i. a **large force acting for a short period of time** and
- ii. a smaller force acting for a longer period of time.

Examples of inertia:

- **Automobiles are fitted with springs and shock absorbers to reduce jerks while moving on uneven roads.**
- In cricket, a fielder pulls back his hands while catching the ball. He experiences a smaller force for a longer interval of time to catch the ball, resulting in a lesser impulse on his hands

40. Which of the following equation show NEWTON'S THIRD LAW OF MOTION?

- a) $F_{\text{net}} = F_a + F_b$
- b) $F_{\text{net}} = F_a - F_b$
- c) **$F_b = -F_a$**
- d) $F_b = F_a$

Explanation

Newton's third law states that 'for every action, there is an equal and opposite reaction. They always act on two different bodies. If a body A applies a force F_A on a body B, then the body B reacts with force F_B on the body A, which is equal to F_A in magnitude, but opposite in direction.

$$F_b = -F_a$$

41. Which of the following are the examples of Newton's third law of motion?

- 1) When a person swims, he pushes the water using the hands backwards, and the water pushes the swimmer in the forward direction.
- 2) When birds fly, they push the air downwards with their wings and the air pushes the bird upwards.
- 3) When we turn the steering wheel, the wheel turns
 - a) 1, 2
 - b) 1, 3
 - c) 2, 3
 - d) All the above

Explanation

Examples Newton's third law of Motion:

- When birds fly, they push the air downwards with their wings (Action) and the air pushes the bird upwards (Reaction).
- When a person swims, he pushes the water using the hands backwards (Action), and the water pushes the swimmer in the forward direction (Reaction).
- When you fire a bullet, the gun recoils backward and the bullet is moving forward (Action) and the gun equalises this forward action by moving backward (Reaction).

42. Which of the following statement is correct?

- a) **There is no change in the linear momentum of a system of bodies as long as no net external force acts on them**
- b) There is no change in the linear momentum of a system of bodies as long as a external force acts on them
- c) There is no change in the linear momentum of a system of bodies as long as no net internal force acts on them
- d) None

Explanation

There is no change in the linear momentum of a system of bodies as long as no net external force acts on them.

$$m_1v_1 + m_2v_2 = m_1u_1 + m_2u_2$$

The above equation confirms in the absence of an external force, the algebraic sum of the momentum after collision is numerically equal to the algebraic sum of the momentum before collision.

43. Propulsion of rockets is based on_____

- a) Newton's 1st law
- b) Newton's 2nd law
- c) **Newton's 3rd law**
- d) None

Explanation

Propulsion of rockets is based on the law of conservation of linear momentum as well as Newton's III law of motion.

44. Which of the following statement is correct?

- 1) Rockets are filled with a fuel (only liquid) in the propellant tank
 - 2) When the rocket is fired, this fuel is burnt and a hot gas is ejected with a high speed from the nozzle of the rocket, producing a huge momentum.
 - 3) To balance this momentum, an equal and opposite reaction force is produced in the combustion chamber, which makes the rocket project forward
- a) 1, 2
 - b) 1, 3
 - c) **2, 3**
 - d) All the above

Explanation

Rockets are filled with a fuel (either liquid or solid) in the propellant tank. When the rocket is fired, this fuel is burnt and a hot gas is ejected with a high speed from the nozzle of the rocket, producing a huge momentum. To balance this momentum, an equal and opposite reaction force is produced in the combustion chamber, which makes the rocket project forward.

45. When rocket moves the mass of the rocket_____

- a) Stays constant
- b) Increases
- c) **Decreases**
- d) None

Explanation

While in motion, the mass of the rocket gradually decreases, until the fuel is completely burnt out. Since, there is no net external force acting on it, the linear momentum of the system is conserved.

46. The mass of the rocket decreases with_____

- a) Temperature
- b) **Altitude**
- c) Fuel
- d) All the above

Explanation

The **mass of the rocket decreases with altitude, which results in the gradual increase in velocity of the rocket**. At one stage, it reaches a velocity, which is sufficient to just escape from the gravitational pull of the Earth. This velocity is called **escape velocity**.

47. Which of the following statement is correct about Newton's universal law of gravitation?

- 1) This law states that every particle of matter in this universe attracts every other particle with a force
- 2) This law is proportional to the square of the distance between the centre of these masses
- 3) This force is directly proportional to the product of their masses
 - a) 1, 2
 - b) 1, 3
 - c) 2, 3
 - d) All the above

Explanation

Newton's universal law of gravitation states that every particle of matter in this universe attracts every other particle with a force. This force is directly proportional to the product of their masses and **inversely proportional to the square of the distance between the centres of these masses**. The direction of the force acts along the line joining the masses.

48. Force between the masses is_____

- a) **Attractive**
- b) Repulsive
- c) Either a or b
- d) None

Explanation

Force between the masses is always attractive and it does not depend on the medium where they are placed.

49. What is the universal gravitational constant?

- a) **$6.674 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$**
- b) $6.674 \times 10^{-11} \text{ N m}^2 \text{ kg}^2$
- c) 9.8 m/s
- d) 9.8 m s

Explanation

Let, m_1 and m_2 be the masses of two bodies A and B placed r metre apart in space,

Force,

$$F \propto m_1 \times m_2$$

$$F \propto 1/r^2$$

$$F = G m_1 m_2 / r^2$$

Where **G is the universal gravitational constant**. Its value in SI unit is

$$6.674 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}.$$

50. When we throw an object upwards, while it returns down_____

- a) **Velocity of the object keeps changing as it falls down**
- b) Velocity will be constant
- c) Initially increase then decrease constant
- d) None

Explanation

The **velocity of the object keeps changing as it falls down. This change in velocity must be due to the force acting on the object.** The acceleration of the body is due to the Earth's gravitational force. So, it is called as 'acceleration due to the gravitational force of the Earth' or 'acceleration due to gravity of the Earth'. It is represented as 'g'. **Its unit is m s^{-2} .**

51. Mean value of the acceleration due to gravity is taken as_____ m/s^2

- a) 10
- b) **9.8**
- c) 9.6
- d) 8.6

Explanation

Mean value of the acceleration due to gravity is taken as 9.8 m s^{-2} on the surface of the Earth. This means that the velocity of a body during the downward free fall motion varies by 9.8 m s^{-1} for every 1 second. However, the value of 'g' is not the same at all points on the surface of the earth.

52. What is the approximate radius of earth?

- a) 9400 km
- b) **6400 km**
- c) 4600 km
- d) 3600 km

Explanation

The **radius of the Earth is $R = 6378 \text{ km} = 6400 \text{ km}$ approximately.** By Newton's law of gravitation, the force acting on the body is given by,

$$F = G M m / R^2.$$

53. What is the equation for Acceleration due to gravity?

- a) **GM / R^2**
- b) GM
- c) $GM R^2$
- d) R^2 / GM

Explanation

According to Newton's second law of motion, the force acting on the body is given by the product of its mass and acceleration (called as weight). Here, acceleration of the body is under the action of gravity hence $a = g$.

$$F = m a = m g$$

$$\text{Acceleration due to gravity } g = GM / R^2$$

54. What is the mass of Earth(kg)?

- a) 5.972×10^{24}
- b) 5.972×10^{37}
- c) 5.972×10^{20}
- d) 5.972×10^{16}

Explanation

Mass of the Earth $M = g R^2 / G$

Substituting the known values of g , R and G ,

you can calculate the **mass of the Earth as $M = 5.972 \times 10^{24} \text{ kg}$**

55. Which of the following statemen is correct?

- 1) Geometric radius of the Earth is maximum in the equatorial region
 - 2) Geometric radius of the Earth is minimum in the equatorial region
 - 3) The value of g is maximum in the polar region and minimum at the equatorial region
- a) 1, 2
 - b) 1, 3
 - c) 2, 3
 - d) **All the above**

Explanation

Since, g depends on the geometric radius of the Earth, ($g \propto 1/R^2$), its value changes from one place to another on the surface of the Earth. **Since, the geometric radius of the Earth is maximum in the equatorial region and minimum in the polar region, the value of g is maximum in the polar region and minimum at the equatorial region.**

56. When you move to a higher altitude from the surface of the Earth, the value of g _____

- a) Increases
- b) **Decreases**
- c) Initially increase then decrease
- d) Initially decrease then increase

Explanation

When you move to a higher altitude from the surface of the Earth, the value of g reduces. In the same way, when you move deep below the surface of the Earth, the value of g reduces. **Value of g is zero at the centre of the Earth.**

57. Which of the following statement is correct?

- 1) Mass of a body is defined as the quantity of matter contained in the body
 - 2) Its SI unit is kilogram (kg)
- a) 1 alone

- b) 2 alone
- c) 1, 2
- d) None

Explanation

Mass is the basic property of a body. Mass of a body is defined as the quantity of matter contained in the body. **Its SI unit is kilogram (kg).**

58. Which of the following statement is correct?

- 1) Weight of a body is defined as the gravitational force exerted on it due to the Earth's gravity alone
- 2) Weight is a Scalar quantity
- 3) SI unit of weight is newton
 - a) 1, 2
 - b) 1, 3
 - c) 2, 3
 - d) All the above

Explanation

Weight is a vector quantity. Direction of weight is always towards the centre of the Earth. **SI unit of weight is newton (N).** Weight of a body varies from one place to another place on the Earth since it depends on the acceleration due to gravity of the Earth (g), which is not the same at all places on the Earth.

59. Which of the following remains constant in Earth and moon?

- a) **Mass**
- b) Weight
- c) Both a and b
- d) None

Explanation

The value of acceleration due to gravity on the surface of the moon is 1.625 ms^{-2} . This is about 0.1654 times the acceleration due to gravity of the Earth. If a person whose mass is 60 kg stands on the surface of Earth, his weight would be 588 N ($W = mg = 60 \times 9.8$). If the same person goes to the surface of the Moon, he would weigh only 97.5 N ($W = 60 \times 1.625$). **But, his mass remains the same (60 kg) on both the Earth and the Moon.**

60. Which of the following statement is incorrect?

- 1) The weight that you feel to possess is not the same as your actual weight called apparent weight.
- 2) Apparent weight is the weight of the body acquired due to the action of gravity and other external forces acting on the body
 - a) 1 alone
 - b) 2 alone

- c) 1, 2
d) None

Explanation

The weight that you feel to possess is not the same as your actual weight called apparent weight. **Apparent weight is the weight of the body acquired due to the action of gravity and other external forces acting on the body.**

61. Match the following:

- | | |
|---------------------------------|--|
| i. Lift is moving upward | 1. Apparent weight is equal to the actual weight |
| ii. Lift is moving downward | 2. Apparent weight is equal to zero |
| iii. Lift is at rest | 3. Apparent weight is greater than the actual weight |
| iv. Lift is falling down freely | 4. Apparent weight is lesser than the actual weight |
- a) 3, 2, 1, 4
b) 2, 1, 3, 4
c) **3, 4, 1, 2**
d) 3, 2, 4, 1

Explanation

Case 1: Lift is moving upward with an acceleration 'a'	Case 2: Lift is moving downward with an acceleration 'a'	Case 3: Lift is at rest .	Case 4: Lift is falling down freely
$R - W = F_{\text{net}} = ma$ $R = W + ma$ $R = mg + ma$ $R = m(g+a)$	$W - R = F_{\text{net}} = ma$ $R = W - ma$ $R = mg - ma$ $R = m(g-a)$	Here, the acceleration is zero $a = 0$ $R = W$ $R = mg$	Here, the acceleration is equal to g $a = g$ $R = m(g - g)$
$R > W$	$R < W$	$R = W$	$R = 0$
Apparent weight is greater than the actual weight.	Apparent weight is lesser than the actual weight.	Apparent weight is equal to the actual weight.	Apparent weight is equal to zero .

62. Which of the following statement is correct?

- 1) We believe that the astronauts in the orbiting space station do not experience any gravitational force of the Earth
 - 2) But this is absolutely correct
 - 3) Astronauts are not floating but falling freely around the earth due to their huge orbital velocity.
- a) 1, 2
b) **1, 3**
c) 2, 3
d) All the above

Explanation

Some of us believe that the astronauts in the orbiting space station do not experience any gravitational force of the Earth. So, they float. But this is absolutely wrong. **Astronauts are not floating but falling freely around the earth due to their huge orbital velocity.** Since space station and astronauts have equal acceleration, they are under free fall condition. Hence, both the astronauts and the space station are in the state of weightlessness.

63. Which of the following statement is correct?

- 1) Dimensions of the heavenly bodies can be measured using the gravitation law
 - 2) Newton's law of gravitation helps in discovering new stars and planets.
 - 3) It helps to predict the path of the astronomical bodies
- a) 1, 2
 - b) 1, 3
 - c) 2, 3
 - d) All the above

Explanation

Application of Newton's law of gravitation:

- 1) **Dimensions of the heavenly bodies can be measured using the gravitation law. Mass of the Earth, radius of the Earth, acceleration due to gravity, etc. can be calculated with a higher accuracy.**
- 2) **Helps in discovering new stars and planets.**
- 3) One of the irregularities in the motion of stars is called 'Wobble' leads to the disturbance in the motion of a planet nearby. In this condition the mass of the star can be calculated using the law of gravitation.
- 4) Helps to explain germination of roots is due to the property of geotropism which is the property of a root responding to the gravity.
- 5) **Helps to predict the path of the astronomical bodies.**

64. Calculate the velocity of a moving body of mass 5 kg whose linear momentum is 2.5 kg m s^{-1} .

- a) 0.5 m s^{-1}
- b) 5 m s^{-1}
- c) 1 m s^{-1}
- d) 50 m s^{-1}

Explanation

Problem-1: Calculate the velocity of a moving body of mass 5 kg whose linear momentum is 2.5 kg m s^{-1} .

Solution: Linear momentum = mass $\times$ velocity

Velocity = linear momentum / mass.

$$V = 2.5 / 5 = 0.5 \text{ m s}^{-1}$$

65. A door is pushed, at a point whose distance from the hinges is 90 cm, with a force of 40N. Calculate the moment of the force about the hinges

- a) 36 Nm
- b) 36 N
- c) 63 Nm
- d) 63 N/m

Explanation

Problem 2: A door is pushed, at a point whose distance from the hinges is 90 cm, with a force of 40 N. Calculate the moment of the force about the hinges.

Solution:

Formula: The moment of a force $M = F \times d$

Given: $F = 40 \text{ N}$ and $d = 90 \text{ cm} = 0.9 \text{ m}$.

Hence, moment of the force $= 40 \times 0.9 = 36 \text{ N m}$.