PHYSICS

BOOKS - TARGET PHYSICS (HINGLISH)

FORCE

Classical Thinking 4 0 Introduction

1. The inability of a body to change by itself, its state of rest or state of motion is called _____ of the body.

A. weight

B. momentum

C. force

D. inertia

Answer: D

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2. Action and reaction forces do not balance each other Why ?

A. they have different magnitude.

B. they are acting at different direction.

C. they are equal in magnitude and opposite in direction acting on two different bodies.

D. they have same direction and have different magnitudes acting on two different bodies.

Answer: C

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3. The total effect of force when it acts for short interval of time is _____.

A. momentum

B. linear momentum

C. impulse

D. acceleration

Answer: C

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4. The momentum is most closely related to

A. impulse

B. kinetic energy

C. angular momentum

D. tengential velocity

Answer: A

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5. A ball of mass 250 g moving with 20 m/s strikes a vertical wall and rebounds along the same line with a velocity of 15 m/s. If the time of contact is 0.1 s, the force exerted by the wall on the ball is

A. $87.5\ \mathrm{N}$

B. $12.5\ \mathrm{N}$

C. $-12.5\ \mathrm{N}$

D. $-87.5\ \mathrm{N}$

Answer: D

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6. A force $\vec{F} = \left(6\hat{i} - 8\hat{j} + 10\hat{k}\right)N$ produces acceleration of $1ms^{-2}$ in a body. Calculate the mass of the body.

A. $2\sqrt{10}\ \mathrm{kg}$

B. $10 \ \mathrm{kg}$

C. $10\sqrt{2} \ \mathrm{kg}$

D. $20 \ \mathrm{kg}$

Answer: C

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Classical Thinking 4 1 Types Of Force

1. A force produced due to interaction between the objects is called_____ force.

A. pseudo

B. impulse

C. real

D. moment of

Answer: C

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2. _____ force is defined in order to apply Newton's laws of motion is accelerated motion.

A. Pseudo

B. Gravitational

C. Real

D. Magnetic

Answer: A

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3. Which of the following is NOT an example of real force ?

A. The earth revolves around the sun.

B. Bus is moving with acceleration in straight line, the passenger experience backward force.

C. Motion between two surfaces in contact.

D. Motion of the moon around the earth.

Answer: B

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Classical Thinking 4 2 General Idea Of Gravitational Electromagnetic And Nuclear Force From Daily Life Experiences

1. _____ forces are charge independent.

A. Strong nuclear

B. Weak gravitational

C. Electrostatic

D. Electromagnetic

Answer: A

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2. Choose the CORRECT statement.

A. The force between two nucleous hold the protons and the neutrons inside the nucleus.

B. Nuclear force obey inverse square law.

C. Weak nuclear force is weaker than gravitational force.

D. Electromagnetic force does not depend on intervening medium.

Answer: A

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3. If the distance between two masses is doubled, gravitational attraction between them

A. is doubled.

B. becomes four times.

C. is reduced to half.

D. is reduced to quarter.

Answer: D

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4. Which of the following is NOT the characteristic of gravitational force ?

A. This force is always attractive and applicable for microscopic as well as macroscopic bodies.

B. Its range is unlimited and it is a very weak force as compared to other real forces.

C. It obeys inverse square law of distance.

D. It depends on intervening medium.

Answer: D

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5. Tidal waves in the sea are primarily due to

A. the atmospheric effect of the earth.

B. the gravitational effect of venus on the earth.

C. the gravitational effect of the sun on the earth.

D. the gravitational effect of the moon on the earth.

Answer: D

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6. The gravitational force of attraction between Earth and Venus, if the distance between them is 2.5×10^7 km, is [mass of Venus = 4.8×1^{24} kg, mass of the Earth $= 6 \times 10^{24}$ kg

A. 4.1×10^{18} N

B. 2.1×10^{18} N

C. 3.1×10^{18} N

D. $5.1 \times 10(18)$ N

Answer: C

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7. The electrostatic and gravitational forces are similar because

A. both are conservative.

B. both are central forces.

C. both follow inverse square law.

D. all of these.

Answer: D

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8. The forces between electric charges in relative motion are called _____.

A. electrostatic forces

B. electromagnetic forces

C. nuclear forces

D. gravitational forces

Answer: B

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9. Nuclear force between proton-proton is _____.

A. repulsive

B. attractive

C. zero

D. infinite

Answer: B

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Classical Thinking 4 3 Law Of Conservation Of Momentum

1. Choose the WRONG statement.

A. The law of conservation of linear momentum holds good for microscopic objects.

B. The law of conservation of linear momentum holds good for macroscopic objects.

C. The law of conservation of linear momentum is true for two objects.

D. The law of conservation of linear momentum is not applicable for two colliding bodies at any angle.

Answer: D

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2. The working of rocket is based on the principle of _____.

A. elasticity

B. Kepler's laws

C. Newton's laws

D. conservation of linear momentum

Answer: D

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3. A light and a heavy body have equal K.E. Which body possesses greater momentum ?

A. Light body

B. Both have equal momentum

C. The heavy body

D. Momentum cannot be predicted

Answer: C

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4. A bullet leaves the rifle of mass one kg and rifle recoils thereby with velocity 30 cm/s. If the mass of the bullet is 3 g, the velocity of the bullet is

A. $10^4 \ \text{cm}/\text{s}$

B. $3 \times 10^2 \ \text{cm}/\text{s}$

C. $10^2 \ \text{cm}/\text{s}$

D. $10 \ \text{cm}/\text{s}$

Answer: A

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5. A bullet of mass 10 g is fired with a velocity of 100 m/s from a rifle of mass 2.5 kg, the recoil velocity of the rifle is

A. $-0.4 \ \text{m}/\text{s}$

B. $+0.4 \ \text{m}/\text{s}$

C. $-4 \ \text{m}/\text{s}$

D. $+4 \ \text{m}/\text{s}$

Answer: A

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6. A 30 kg shell is flying at 48 ms^{-1}. When it explodes, its one part of 18 kg stops, while the remaining part flies on. Find the velocity of the later.

A. 120 $\mathrm{m\,s^{-1}}$

B. 100 $\mathrm{m\,s^{-1}}$

C. 60 $\mathrm{m\,s^{-1}}$

D. 48 $\mathrm{m\,s^{-1}}$

Answer: A

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7. Two billiard balls each of mass 0 .05 kg moving in opposite directions with speed $6ms^{-1}$ collide and rebound with the same speed What is the impulse imparted to each ball due to the other ?

A. $-0.6 \ \mathrm{kg\,m\,s^{-1}}, 0.6 \ \mathrm{kg\,m\,s^{-1}}$

B. $-0.6 \ \mathrm{kg\,m\,s^{-1}}, \ -0.6 \ \mathrm{kg\,m\,s^{-1}}$

C. $0.6 \ \mathrm{kg\,m\,s^{-1}}, 0.6 \ \mathrm{kg\,m\,s^{-1}}$

D. $0.3 \ \mathrm{kg\,m\,s^{-1}}, 0.3 \ \mathrm{kg\,m\,s^{-1}}$

Answer: A

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8. Work is always done on a body when

A. a force acts on body to displace it.

B. it moves through a certain distance.

C. it experiences an increase in energy through a mechanical influence.

D. there is no displacement.

Answer: A

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9. Under the action of variable force, at any instant the displacement is

A. assumed to be infinitesimally small so that the force is assumed to be constant.

B. constant whatever be the magnitude of force.

C. half the magnitude of force.

D. assumed to be infinitesimally small so that the force is assumed to be perpndicular to the displacement.

Answer: A

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10. When a body goes away from the centre of the earth, its gravitational force goes on decreasing. This is an example of _____.

A. constant force

B. variable force

C. division of force

D. multiplication of force

Answer: B

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11. Choose the CORRECT statement.

A. Increase in the kinetic energy of the body is equal to the work done by the body against the opposing force.

B. Decrease in the kinetic energy of the body is equal to the work done by the body against the opposing force.

C. Increase in potential energy of the body is equal to the work done by the body against the external force in the opposite direction.

D. Decrease in potential energy of the body is equal to the work done by the body against the opposing force in the same direction.

Answer: B

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12. If the kinetic energy decreases the work done is _____.

A. zero

B. negative

C. positive

D. double

Answer: B

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13. A cyclist comes to skidding spot in 10 m. If the opposing force on the cycle due to the road is 200 N. The work done by the road on the cycle is

A. 2000 J

B. -2000 J

C. 1000 J

D. -1000 J

Answer: B

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Classical Thinking 4 4 Elastic And Inelastic Collision In One And Two Dimensions

1. A shell in its flight, explodes into four unequal parts. Which of the following is conserved?

A. Momentum

B. Kinetic energy

C. Potential energy

D. Gravitational energy

Answer: A

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2. When two bodies stick together after collision, the collision is said to be

A. perfectly elastic

B. perfectly inelastic

C. partly elastic

D. partly inelastic

Answer: B

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3. Which of the following is NOT an example of inelastic collision?

A. A meteorite collides head-on on the earth.

B. Lump of mud thrown on the wall sticks to the wall.

C. A ball allowed to fall on hard surface, does not bounce to original height.

D. The gas molecules in the container strikes the wall of the container.

Answer: D

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4. For perfectly elastic collision

A. $v_2 - v_1 = u_2 - u_1$

B. $v_1 - v_2 = u_1 - u_2$

C. $v_2 - v_1 = u_1 - u_2$

D. $v_2 - v_1 = \frac{u_1 + u_2}{2}$

Answer: C

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5. When a massive body suffers an elastic collision with a stationary light body, then massive body approximately comes to rest and light body

A. acquires velocity greater than initial velocity of massive body.

B. sticks to the massive body and remains at rest.

C. acquires half the initial velocity of the massive body.

D. remains at rest but does not stick to the massive body.

Answer: A

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6. A ball of mass 5 kg travelling with velocity of 15 cm/s makes a head on collision with another ball of mass 1 kg which is at rest. After the collision, the speed of the lighter ball is

A. zero.

B. less than 15 cm/s.

C. equal to 15 cm/s.

D. greater than 15 cm/s.

Answer: D

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7. The ratio of relative velocity of separation after collision to the relative velocity of approach before collision between two colliding bodies is _____.

A. coefficient of restitution

B. velocity of collision

C. sum of the velocities

D. the law of gravitation

Answer: A

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8. A block of mass m moving at speed v collides wilth another block of mass 2 m at rest. The lighter block comes to rest after the collision. Find the coefficient of restitution.

A. 0.8

B. 0.6

C. 0.5

D. 0.4

Answer: C

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9. A body of mass 0.1 kg travelling with a velocity of 5 m/s, collides head-on with another body of mass 0.2 kg travelling in the same direction with a velocity of 1.2 m/s. If the two bodies stick together after collision, their common velocity is

A. $0.967 \quad \mathrm{m}/s$

B. $1.233 \quad \mathrm{m}/\mathrm{s}$

C. $2.467 \quad \mathrm{m}/\mathrm{s}$

D. $2.524 \quad \mathrm{m}/\mathrm{s}$

Answer: C

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10. A body of mass m moving with velocity $3km/h$ collides with a body of mass 2m at rest. Now, the coalesced mass starts to move with a velocity

A. $4 \ \mathrm{km\ h^{-1}}$

B. $3 \ \mathrm{km\ h^{-1}}$

C. $2 \ \mathrm{km\ h^{-1}}$

D. $1 \ \mathrm{km\ h^{-1}}$

Answer: D

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Classical Thinking 4 5 Inertial And Non Inertial Frames

1. A system of coordinates of an observer used to describe any motion is called_____.

A. coordinate axes

B. origin of motion

C. frame of reference

D. absolute frame of reference

Answer: C

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2. INERTIAL FRAME OF REFERENCE

A. Newton's laws of motion hold good for real forces.

B. the frames accelerate uniformly.

C. Newton's laws of motion do not hold good.

D. fictitious force acts in it.

Answer: A

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3. A frame of reference which moves with constant velocity with reference to a stationary frame of reference is called_____.

A. inertial frame of reference

B. non-inertial frame of reference

C. rotating frame of reference

D. absolute frame of reference

Answer: A

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4. A frame of reference in which Newton's law of inertia does not hold ggood is called_____.

A. inertial frame of reference

B. non-inertial frame of reference

C. polar frame of reference

D. psuedo frame of reference

Answer: B

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5. Non-inertial frame of reference have

A. zero acceleration.

B. some acceleration with respect to inertial frame of reference.

C. zero velocity.

D. constant velocity with respect to inertial frame of reference.

Answer: B

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6. A passenger sitting in a bus moving along a circular path experiences a force which is

A. opposite to the acceleration of the bus.

B. in the same direction as that of the acceleration of the bus.

C. along the direction of motion of the bus.

D. opposite to the direction of motion of the bus.

Answer: A

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Classical Thinking 4 6 Moment Of Force

1. If the relative displacement between any two particles of a body does not change under the application of force of any magnitude, the body is said to be a _____.

A. stationary body

B. elastic body

C. plastic body

D. rigid body

Answer: D

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2. The turning effect of the applied force does NOT depend upon

A. magnitude of the force.

B. direction of the force.

C. moment arm of the force.

D. material and its distance from axis of rotation.

Answer: D

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3. The ability of a force to produce rotational motion is measured by its turning effect and it is called_____.

A. momentum

B. power

C. energy

D. torque

Answer: D

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4. The direction of torque is given by _____.

A. direction of force only

B. direction of moment arm

C. right hand screw rule

D. left hand screw rule

Answer: C

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5. The unit of moment of force is same as _____.

A. power

B. acceleration

C. momentum

D. work

Answer: D

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Classical Thinking 4 7 Couple And Properties Of Couple

1. Torque can NOT be given by

A. product of magnitude of the force and lever arm of the force.

B. product of magnitude of the force and perpendicular distance between its line of action of the force.

C. product of magnitude of force and moment arm of the force.

D. product of magnitude of the force and maximum distance covered.

Answer: D

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2. A rigid body is rotating about an axis. The best way to stop it is applying

A. pressure at the turning point.

B. upward force at the turning point.

C. downward force at the free end.

D. torque in opposite direction.

Answer: D

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3. The torque of the force $\vec{F} = \left(2\hat{i} - 3\hat{j} + 4\hat{k}\right)N$ acting at the point $\vec{r} = \left(3\hat{i} + 2\hat{j} + 3\hat{k}\right)m$ about the origin be

A. $\left(\hat{i} + 18\hat{j} - 13\hat{k}\right)\mathrm{N\ m}$

B. $\left(\hat{i} + 18\hat{j} + 13\hat{k}\right)\mathrm{N\ m}$

C. $\left(-\hat{i} - 18\hat{j} - 13\hat{k}\right)\mathrm{N\ m}$

D. $\left(\hat{i} - 18\hat{j} - 13\hat{k}\right)\mathrm{N\ m}$

Answer: A

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4. A mass of 10 kg is suspended from a rope wound on a wheel of diameter 40 cm. The torque about the axis of rotation is

A. $39.2\ \mathrm{N\ m}$

B. 19.6 N m

C. 4 N m

D. 2 N m

Answer: B

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5. _____ is a pair of equal and parallel forces acting in opposite directions at two different points of a given body

A. Couple

B. Moment of force

C. Pseudo force

D. Moment arm

Answer: A

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6. The moment of couple is independent of

A. the point about which the moment is found.

B. magnitude of the force.

C. magnitude of the distance between line of action of force and perpendicular distance.

D. angle made by the line of action of force.

Answer: A

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7. Force applied to open or close a water tap is an example of _____.

A. elastic collision

B. conservation of momentum

C. couple

D. application of Newton's law of motion

Answer: C

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8. If the force applied to a body produces rotational motion in an anticlockwise sense, the moment of the force is considered as _____.

A. negative

B. zero

C. positive

D. infinity

Answer: C

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Classical Thinking 4 8 Centre Of Mass

1. A point at which the whole mass of the body is supposed to be concentrated in order to studt the motion of an external force in accordance with Newton's laws of motion is

A. centre of gravity

B. centre of mass

C. the point on the surface

D. the end point of rod

Answer: B

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2. The centre of mass of two particles system lies

A. on the line joining the particles.

B. along the third quadrent of coordinate axes.

C. on the line perpendicular to the line joining the particles.

D. at the midpoint on the line joining the two particle.

Answer: A

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3. Where does the centre of mass of a uniform rectangular lamina lie ?

A. longer side.

B. shorter side.

C. one of its point inside the lamina.

D. point of intersection of the diagonals.

Answer: D

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4. Three equal masses each of 50 g, are placed at the corners of a right angled isoceles triangle whose two equal sides are 5 cm each. The position of the centre of mass of the system is

A. $x = 5 \text{ cm}, y = 5 \text{ cm}$

B. $x = \frac{5}{3} \text{ cm}, y = 5 \text{ cm}$

C. $x = \frac{5}{3} \text{ cm}, y = \frac{5}{2} \text{ cm}$

D. $x = \frac{5}{3} \text{ cm}, y = \frac{5}{3} \text{ cm}$

Answer: D

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5. Point masses of 2 kg, 3 kg, 5 kg and 7 kg are placed at the corners of a square ABCD respectively whose each side is 1 m long. The position of the centre of mass of the system is

A. $\frac{14}{17}m, \frac{8}{17}m$

B. $\frac{12}{17}m, \frac{10}{17}m$

C. $\frac{15}{17}m, \frac{10}{17}m$

D. $\frac{12}{17}m, \frac{8}{17}m$

Answer: D

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6. The centre of mass of a system of two uniform spherical masses of 5 kg and 35 kg with centres of them 0.7 m apart is

A. 0.6125 m from 35 kg

B. 0.6125 m from 5 kg

C. 0.35 m from 35 kg

D. 0.35 m from 5 kg

Answer: B

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Classical Thinking 4 9 Centre Of Gravity

1. A point through which total weight of the body always acts vertically downwards whatever may be the position of the body is _____.

A. centre of mass

B. rigid body

C. centre of gravity

D. geometrical centre

Answer: C

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2. For regular shapes of the small body, which of the following statement is true?

A. The centre of mass coincides with centre of gravity.

B. The centre of mass is lower than centre of gravity.

C. The centre of mass is higher than centre or gravity.

D. The centre of mass is at half the distance of centre of gravity.

Answer: A

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3. For a circular ring, centre of gravity lies

A. away from the ring

B. at the geometrical centre

C. on the edge of the ring

D. none of the above

Answer: B

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Classical Thinking 4 10 Conditions Of Equilibrium Of A Rigid Body

1. Condition of translational equilibrium of a rigid body is

A. $\sum \vec{f} = 0$

B. $\sum \vec{f} \neq 0$

C. $\sum \vec{\tau} = 0$

D. $\sum \vec{\tau} = 2$

Answer: A

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2. $\sum_{i=1}^{n} \vec{r_i} \times \vec{f_i} = 0$ is the condition of_____.

A. translational equilibrium

B. stationary object

C. constant linear acceleration

D. rotational equilibrium

Answer: D

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3. 6 m long see-saw remains horizontal when two children weighing 20 kg and 30 kg respectively sit at two ends. Where is the see-saw supported?

A. 3.6 m from 20 kg

B. 2.6 m from 30 kg

C. 4 m from 20 kg

D. 4.2 m from 30 kg

Answer: A

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Classical Thinking Miscellaneous

1. An athelete runs a certain distance before taking a long jump . Why ?

A. it gives energy to him for long jump.

B. it helps to apply large force.

C. by running, the gives himself large inertia of motion.

D. by running, action and reaction forces increase.

Answer: C

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2. A bomb of mass 9 kg explodes into two pieces of mass 3 kg and 6 kg. The velocity of mass 3 kg is 16 m/s, The kinetic energy of mass 6 kg is

A. 96 J

B. 192 J

C. 384 J

D. 768 J

Answer: B

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3. The average force necessary to stop a bullet of mass 20 g moving with a speed of 250 m/s , as it penetrates into the wood for a distance of 12 cm is

A. $5.2 \times 10^3 \ \mathrm{N}$

B. $750 \ \mathrm{N}$

C. $625 \ \mathrm{N}$

D. $520 \ \mathrm{N}$

Answer: A

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Critical Thinking 4 0 Introduction

1. When a force is exerted on a body it can change its_____.

A. speed

B. direction of motion

C. momentum

D. all of these.

Answer: D

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2. A rider on horse back falls when horse starts running all of a sudden because

A. of inertia of motion.

B. of pseudo force acting on the rider.

C. inertia of rest keeps the upper part of body at rest whereas lower part of the body moves forward with the horse.

D. of losing balance.

Answer: C

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3. A student unable to answer a question on Newton's laws of motion attempts to pull himself up by tugging on her hair. He will not succeed.

A. as the force exerted is samll

B. the frictional force while gripping, is small.

C. newton's law of inertia is not applicable to living beings.

D. as the force applied is internal to the system.

Answer: D

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4. Human heart is pumping blood with constant velocity v m s^{-1} at the rate of M kg s^{-1}. The force required for this is (in N)

A. M

B. Mv

C. $\frac{M}{v}$

D. $v\frac{\mathrm{dM}}{\mathrm{dt}}$

Answer: B

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5. If two balls each of mass $0.06kg$ moving in opposite directions with speed $4m/s$ collide and rebound with the same speed , then the impulse imparted to each ball due to other is

A. $0.48 \ \mathrm{kg\,m/s}$

B. $0.24 \ \mathrm{kg\,m/s}$

C. $0.81 \ \mathrm{kg\,m/s}$

D. Zero

Answer: A

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6. A ball weighing 10g hits a hard surface vertically with a speed of 5m/s and rebounds with the same speed. The ball remains in contact with the surface for 0.01s. The average force exerted by the surface on the ball is

A. 100 N

B. 10 N

C. 1 N

D. 0.1 N

Answer: B

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7. The linear momentum p of a body moving in one dimension varies with time according to the equation $p = a + bt^2$ where a and b are positive constants. The net force acting on the body is

A. a constant

B. proportional to t^2

C. inversely proportional to t

D. proportional to t

Answer: D

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8. If the tension in the rope of a life is zero, then the acceleration of life is

A. $(g + a)$

B. g

C. zero

D. $(g - a)$

Answer: B

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9. A paarticle moves in the xy-plane under the action of a force F such that the componentes of its linear momentum p at any time t and $p_x = 2\cos t, p_y = 2\sin t$. the eangle between F and p at time l is

A. 90°

B. 0°

C. 180°

D. 30°

Answer: A

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Critical Thinking 4 1 Types Of Force

1. A closed compartment containing gas is moving with some acceleration in horizontal direction. Neglect effect of gravity. Then the pressure in the compartment is

A. same everywhere.

B. lower in front side.

C. lower in rear side.

D. lower in upper side.

Answer: B

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Critical Thinking 4 2 General Idea Of Gravitational Electromagnetic And Nuclear Force Electromagnetic And Nuclear Force From Daily Life Experiences

1. Newton's law of gravitation is universal because

A. it is always attractive.

B. it acts on all heavenly bodies and particles.

C. it acts on all masses at all the distances and is not affected by the medium.

D. it is accepted by all the scientist.

Answer: C

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Critical Thinking 4 3 Law Of Conservation Of Momentum

1. The momentum of a system is conserved

A. always

B. never

C. in the absence of an external force on the system

D. in linear motions only

Answer: C

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2. A collision of two objects occurs in an inertial frame of reference A. It is also observed by an observed in another inertial frame of reference B moving uniformly with respect to the frame A along the z-axis. Which one of the following is correct?

A. The momentum is conserved in both the frames but the energy may not.

B. The energy is conserved in both the frames but the momentum may not.

C. Momentum along the z-axis only is conserved in the two frames.

D. Both energy and momentum are conserved in both the frames.

Answer: D

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3. Assertion : A bullet is fired from a rifle. If the rifle recoils freely, the kinetic energy of rifle is more than that of the bullet.

Reason : In the case of rifle bullet system the law of conservation of momentum violates.

A. Assertion is True, Reason is True, Reason is a correct explanation for Assertion

B. Assertion is True, Reason is True, Reason is not a correct explanation for Assertion

C. Assertion is True, Reason is False

D. Assertion is False, Reason is False.

Answer: D

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4. A body of mass M at rest explodes into three pieces, two of which of mass M//4 each are thrown off in prependicular directions eith velocities of $3/s$ and $4m/s$ respectively. The third piece willl be thrown off with a velocity of

A. $1.5 \ \mathrm{m/s}$

B. $2.0 \ \mathrm{m/s}$

C. $2.5 \ \mathrm{m/s}$

D. $3.0 \ \mathrm{m/s}$

Answer: C

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5. A body of mass explodes at rest break up into three parts.If two parts having equal masses fly off perpendicularly to each other with a velocity of $18m/s$, then calculate the velocilty of the third part which has a mass 3 times the mass of each part.

A. $6\sqrt{2}$ m/second and 135° from either

B. $6\sqrt{2}$ m/second and 45° from either

C. $\frac{6}{\sqrt{2}}$ m/second and 135° from either

D. $\frac{6}{\sqrt{2}}$ m/second and 45° from either

Answer: A

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6. A bullet moving with a speed of 400 m/s penetrates a sand bag and drops dead inside it. The masses of the bullet and the sand bag are 0.25

kg and 4.75 kg respectively. If the bag is free to move, its velocity shall be (in m/s)

A. 10

B. 15

C. 21

D. 50

Answer: C

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7. A ball moving with a speed of 10 m s^{-1} strikes an identical ball such that after the collision the direction of each ball makes an angle 45° with the original line of motion. Find the speeds of the two balls after the collision.

A. $v_1 = 5\sqrt{2} \text{ m/s}, v_2 = 10\sqrt{2} \text{ m/s}$

B. $v_1 = 10\sqrt{2} \text{ m/s}, v_2 = 10\sqrt{2} \text{ m/s}$

C. $v_1 = 5\sqrt{2}\ \text{m/s}, v_2 = 5\sqrt{2}\ \text{m/s}$

D. $v_1 = 3\sqrt{2}\ \text{m/s}, v_2 = 10\sqrt{2}\ \text{m/s}$

Answer: C

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8. Under the action of variable force, at any instant the displacement is

A. 

B. 

C. 

D. 

Answer: A

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9. A force of $F = (0.5x + 12)N$ acts on a particle. If x is in metre, calculate the work done by the force during the displacement of the particle from x = 0 to x = 4 m

A. 128 J

B. 80 J

C. 64 J

D. 52 J

Answer: D

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Critical Thinking 4 4 Elastic And Inelastic Collisions In One And Two Dimensions

1. One metallic sphere is at rest. Another metallic sphere hits the first and comes to rest and second sphere moves. The ratio of their masses is

A. $\frac{m_1}{m_2} < 1$

B. $\frac{m_1}{m_2} > 1$

C. $\frac{m_1}{m_2} = 1$

D. $\frac{m_1}{m_2} = 2$

Answer: C

Watch Video Solution

2. A body of mass 2 kg, travelling at 4 m/s makes a head-on collision with a body of mass 1 kg travelling in the opposite direction with a velocity of 2 m/s, the velocities of the two bodies after collision are

A. $v_1 = 6 \ \ \mathrm{m/s}, v_2 = 6 \ \ \mathrm{m/s}$

B. $v_1 = 0, v_2 = 0$

C. $v_1 = 0 \ \ \mathrm{m/s}, v_2 = 6\frac{\mathrm{m}}{\mathrm{s}}$

D. $v_1 = 6 \ \ \mathrm{m/s}, v_2 = 0$

Answer: C

Watch Video Solution

3. A ball of 0.1 kg makes an elastic head on collision with a ball of unknown mass that is initially at rest. If the 0.1kg ball rebounds at one third of its original speed, what is the mass of the other ball?

A. 0.1 kg

B. 0.2 kg

C. 0.3 kg

D. 0.4 kg

Answer: B

Watch Video Solution

4. A body of mass 1 kg moving with velocity 5 m/s collides with another body of mass 2 kg moving with velocity 1.5 m/s in opposite direction. If the coefficient of restitution is 0.8, their velocities aftter collision respectively are

A. $-2.8 \ \mathrm{m/s}, \ +2.4 \ \mathrm{m/s}$

B. $+2.8 \ \mathrm{m/s}, \ -2.4 \ \mathrm{m/s}$

C. $-1.67 \ \mathrm{m/s}, \ -2.4 \ \mathrm{m/s}$

D. $+2.8 \ \mathrm{m/s}, \ -6.84 \ \mathrm{m/s}$

Answer: A

Watch Video Solution

Critical Thinking 4 6 Moment Of Force

1. When a torque acting upon a system is zero, which of the following will be constant ?

A. Force

B. Linear momentum

C. Angular momentum

D. Linear impulse

Answer: C

Watch Video Solution

Critical Thinking 4 8 Centtre Of Mass

1. Two persons of masses $55kg$ and $65kg$ respectively are at the opposite ends of a boat. The length of the boat is $3.0m$ and weights $100kg$. The $55kg$ man walks up to the $65kg$ man and sits with him. If the boat is in still water the centre of mass of the system shifts by.

A. 3.0 m

B. 2.3 m

C. zero

D. 0.75 m

Answer: C

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2. Particle of masses $m, 2m, 3m, \ldots, nm$ grams are placed on the same line at distance $l, 2l, 3l, \ldots\ldots, nlcm$ from a fixed point. The distance of centre of mass of the particles from the fixed point in centimeters is :

A. $\frac{(2n+1)l}{3}$

B. $\frac{l}{n+1}$

C. $\frac{n(n^2+1)l}{2}$

D. $\frac{2l}{n(n^2+1)}$

Answer: A

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Critical Thinking 4 9 Centre Of Gravity

1. When a bus is climbing on hilly road, a standing passenger, balances himself by keeping legs apart to achieve balance by keeping C.G._____.

A. left side of him

B. right side of him

C. back side of him

D. within the legs

Answer: D

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Critical Thinking 4 10 Conditions Of Equilibrium Of A Rigid Body

1. Two men A and B support the ends of a uniform beam 2 m long and weighing 50 kg. A weight of 50 kg hangs from the beam from a point 0.5 m from A. Assuming the bar is horizontal, the load shared by each man is

A. A = 37.5 kg wt and B = 62.5 kg wt

B. A = 50 kg wt and B = 50 kg wt

C. A = 62.5 kg wt and B = 37.5 kg wt

D. A = 72.5 kg wt and B = 27.5 kg wt

Answer: C

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2. A uniform bar RS weighs 100 g and is 80 cm long. From the end R, two masses 50 g and 100 g are hung from the bar at a distance of 10 cm and 60 cm respectively. If the bar is to remain horizontal when balanced on a knifeedge, its position is

A. 42 cm from S

B. 38 cm from R

C. 38 cm from G

D. 42 cm from R

Answer: D

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3. A steel bar AB of mass 10 kg and length 1 m is kept horizontal by supporting it at the two ends. Two weights of 4 kg and 6 kg are suspended from points of the bar at distances 30 cm and 80 cm respectively from the end A. The reaction at the end A is

A. 107.8 N

B. 97.8 N

C. 88.2 N

D. 78.2 N

Answer: C

Watch Video Solution

Critical Thinking Miscellaneous

1. A man weighing $80kg$ is standing on a trolley weighting $320kg$. The trolley is resting on frictionless horizontal rails. If the man starts walking on the trolley along the rails at speed $1m/s$ (w.r.t. to trolley) then after $4s$ his displacement relative to the ground will be :

A. 5 m

B. 4.8 m

C. 3.2 m

D. 3.0 m

Answer: C

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2. A shell is fired from a cannon with a velocity $v(m/s)$ at an angle θ with the horizontal direction. At the highest point in its path it explodes into two pieces of equal mass. on, of the pieces retraces its path to the cannon and the speed, (in m/s) of the other piece immediately after the explosion is

A. $3v\cos\theta$

B. $2v\cos\theta$

C. $\frac{3}{2}v\cos\theta$

D. $\frac{\sqrt{3}}{2}v\cos\theta$

Answer: A

Watch Video Solution

3. A machine gun has a mass 5 kg. It fires 50 gram bullets at the rate of 30 bullets per minute at a speed of $400\ \mathrm{m\,s^{-1}}$. What force is required to

keep the gun in positon ?

A. 10 N

B. 5 N

C. 15 N

D. 30 N

Answer: A

Watch Video Solution

4. A rocket of initial mass $6000kg$ ejects mass at a constant rate of $16kg/s$ with constant relative speed of $11m/s$ What is the acceleration of the rocket one mnute after blast ?

A. $25\ \mathrm{m/s^2}$

B. $50\ \mathrm{m/s^2}$

C. $10\ \mathrm{m/s^2}$

D. $35 \ \mathrm{m/s^2}$

Answer: D

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5. A machine gun fires a bullet of mass 40 g with a velocity $1200ms^{-1}$. The man holding it can exert a maximum force of 144 N on the gun. How many bullets can be fire per second at the most?

A. only one

B. 3

C. any number of bullets

D. 144×48

Answer: B

Watch Video Solution

6. Consider the following statement. When jumping from some height, you should bend your knees as you come to rest instead of keeping your legs stiff. Which of the following relations can be useful in explaining the statement?

A. $\Delta\overrightarrow{p_1} = -\Delta\overrightarrow{p_2}$

B. $\Delta E = \Delta(PE + KE) = 0$

C. $\overrightarrow{F}\,\Delta t = m\Delta\overrightarrow{v}$

D. $\Delta\overrightarrow{x} \propto \Delta\overrightarrow{F}$

Answer: C

Watch Video Solution

7. Which of the following has maximum momentum ?

A. A 100 kg vehicle moving at $0.02\ \ \mathrm{m\,s^{-1}}$.

B. A 4 g weight moving at $1000\ \ \mathrm{cm\,s^{-1}}$.

C. A 200 g weight moving with kinetic energy of $10^{-6} J$.

D. A 200 g weight after falling through one kilometre.

Answer: D

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8. With what minimum acceleration can a fireman slide down a rope whose breaking strength is $(2/3)$ of his weight?

A. g

B. $\frac{2}{3}$g

C. $\frac{1}{3}$g

D. zero

Answer: C

Watch Video Solution

9. A cold soft drink is kept on the balance. When the cap is open, then the weight

A. increases

B. decreases

C. first increases then decreases

D. remains same

Answer: C

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10. A stationary body of mass 3 kg explodes into three equal pieces. Two of the pieces fly off in two mutually perpendicular directions, one with a velocity of $3\hat{i}ms^1$ and the other with a velocity of $4\hat{j}ms^{-1}$. - If the explosion occurs in $10^{-4}s$, the average force acting on the third piece in newton is

A. $\left(3\hat{i}+4\hat{j}\right)\times 10^{-4}$

B. $\left(3\hat{i}-4\hat{j}\right)\times 10^{-4}$

C. $\left(3\hat{i}+4\hat{j}\right)\times 10^{4}$

D. $-\left(3\hat{i}+4\hat{j}\right)\times 10^{4}$

Answer: D

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Competitive Theinking 4 0 Introduction

1. When a bus suddenly takes a turn, the passengers are thrown outwards because of

A. inertia of motion

B. acceleration of motion

C. speed of motion

D. both (B) and (C)

Answer: A

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2. The impulse on a particle due to a force acting on it during a given time interval is equal to the change in its

A. acceleration

B. momentum

C. energy

D. velocity

Answer: B

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3. A cricket ball of mass 0.5 kg strikes a circket bat normally with a velocity of $20 \ \mathrm{m\,s^{-1}}$ and rebounds with a velocity of $10 \ \mathrm{m\,s^{-1}}$. The impulse of

the force exerted by the ball on the bat is

A. 15 N s

B. 25 N s

C. 30 N s

D. 10 N s

Answer: A

Watch Video Solution

4. An aircraft is moving with a velocity of $300ms^{-1}$. If all the forces acting on it are balanced, then

A. it still moves with the same velocity.

B. It will be just floating at the same point in space.

C. it will fall down instantaneously.

D. it will lose its velocity gradually.

Answer: A

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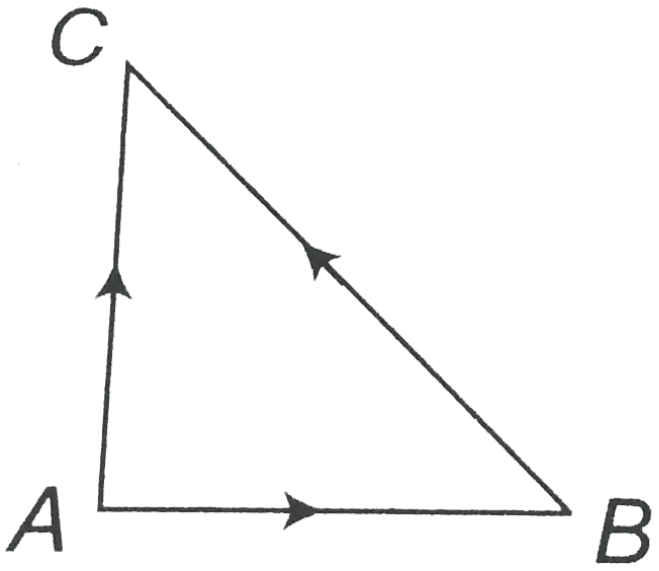
5. Three forces start acting simultaneously on a particle moving with velocity $\vec{v}$. These forces are represented in magnitude and direction by the three sides os a triangle ABC (as shown). The particle will now move with velocity.



A. less then $\vec{v}$.

B. more then $\overrightarrow{v}$.

C. $\overrightarrow{v}$ only.

D. cannot say.

Answer: C

Watch Video Solution

6. A rocket with a lift-off mass $3.5 \times 10^4 kg$ is blasted upwards with an initial acceleration of $10 m / s^2$. Then the initial thrust of the blast is

A. 1.75×10^5 N

B. 3.5×10^5 N

C. 7.0×10^5 N

D. 14.0×10^5 N

Answer: C

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7. A body of mass 'M' collides against a wall with a velocity v and retraces its path with the same speed. The change in momentum is (take initial direction of velocity as positive)

A. 2mv

B. mv

C. $-mv$

D. zero

Answer: A

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8. A balloon has 5 g of air. A small hole is pierced into it. The air escapes at a uniform rate with a velocity of 4 cm/s. If the balloon shrinks completely in 2.5 s, then the average force acting on the balloon is

A. 2 dyne

B. 2 N

C. 8 dyne

D. 8 N

Answer: C

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9. A mass of 1 kg is suspended by means of a thread. The system is (i) lifted up with an acceleration of $4.9ms^2$ (ii) lowered with an acceleration of $4.9ms^{-2}$. The ratio of tension in the first and second case is

A. $3:1$

B. $1:2$

C. $1:3$

D. $2:1$

Answer: A

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10. Ten one-rupee coins are put on top of each other on a table, Each coin has a mass m. Which of the following statements in not ture?

A. The force on the 6^{th} coins (counted from the bottom) due to all the coins on its top is equal to 4 mg (downwards).

B. The force on 6^{th} coin due to 7^{th} coin is 4mg (downwards).

C. The reaction of the 6^{th} coin on the 7^{th} coin is 4mg (upwards).

D. The total force on the 10^{th} coin is 9 mg (downwards).

Answer: D

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11. A body of mass 50 kg is suspended using a spring balance inside a lift at rest. If the lift startts falling freely, the reading of the spring balance is

A. < 50 kg

B. $= 50 \ \ \text{kg}$

C. > 50 kg

D. $= 0$

Answer: D

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12. A stone of mass 0.05 kg is thrown vertically upwards. What is the direction and magnitude of net force on the stone during its upward motion?

A. 0.98 N vertically downwards.

B. 0.49 N vertically upwards.

C. 9.8 N vertically downwards.

D. 0.49 N vertically upwards.

Answer: D

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13. A man weighing 60 kg is in a lift moving down with an acceleration of $1.8 \ \mathrm{ms}^{-2}$. The force exerted by the floor on him is

A. 588 N

B. 480 N

C. Zero

D. 696 N

Answer: B

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14. When a force F is applied to a mass m_1, its acceleration is $6\ \mathrm{m/s^2}$. If the same force is applied to another mass m_2, it gives an acceleration $3\ \mathrm{m/s^2}$. If the two masses are tied together and if the same force is applied to the combination it gives an acceleration

A. $1\ \mathrm{m/s^2}$

B. $3\ \mathrm{m/s^2}$

C. $2\ \mathrm{m/s^2}$

D. $1.5\ \mathrm{m/s^2}$

Answer: C

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Competitive Theinking 4 2 General Idea Of Gravitational Electromagnetic And Nuclear Force From Daily Life Experiences

1. which of the following is correct order fo forces?

A. Weak $<$ gravitational forces $<$ strong forces (nuclear) $<$ electrostatic

B. Gravitational $<$ weak $<$ (electrostatic) $<$ strong force

C. Gravitational $<$ electrostatic $<$ weak $<$ strong force

D. Weak $<$ gravitational $<$ electrostatic $<$ strong forces

Answer: B

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2. Two particles of mass m_1 and m_2, approach each other due to their mutual gravitational attraction only. Then

A. accelerations of both the particles are equal.

B. acceleration of the particle of mass m_1 is proportional to m_1.

C. acceleration of the particle of mass m_1 is proportional to m_2.

D. acceleration of the particle of mass m_1 is inversely proportional to m_1.

Answer: C

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3. If mass of a body is M on the earth surface, then the mass of the same body on the moon surface is

A. 6 M

B. M/6

C. zero

D. M

Answer: D

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Competitive Theinking 4 3 Law Of Conservation Of Momentum

1. An explosion blows a rock into three parts. Two parts go off at right angles to each other . These two are $1kg$ first part moving with a velocity of $12ms^{-1}$ and $2kg$ second part moving with a velocity of $8ms^{-1}$. If the third part flies off with a velocity of $4ms^{-1}$. Its mass would be

A. 3 kg

B. 5 kg

C. 7 kg

D. 17 kg

Answer: B

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2. A bomb at rest explodes into 3 parts of same mass. The momentum of two parts is $-3p\hat{i}$ and $2p\hat{j}$. Respectively. The magnitude of momentum f

the third part is

A. P

B. $\sqrt{5}P$

C. $\sqrt{11}P$

D. $\sqrt{13}P$

Answer: D

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3. A bullet fired from gun with a velocity 30 m/s at an angle of 60° with horizontal direction. At the highest point of its path, the bullet explodes into two parts with masses in the ratio 1 : 3. The lighter mass comes to rest immediately. Then the speed of the heavier mass is

A. 30 m/s

B. 20 m/s

C. 10 m/s

D. 5 m/s

Answer: B

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4. A body of mass $1kg$, initially at rest, explodes and breaks into three fragments of masses in the ratio $1:1:3$. The two pieces of equal mass fly off perpendicular to each other with a speed of $30m/s$ each. What is the velocity of the heavier fragment?

A. $10\sqrt{2}$

B. 6

C. 3

D. $6\sqrt{2}$

Answer: A

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5. A bullet of mass $10g$ moving horizontally with a velocity of $400ms^{-1}$ strickes a wooden block of mass $2kg$ which is suspended by a light inextensible string of length $5m$. As a result, the center ofgravity of the block is found to rise a vertical distance of $10cm$. The speed of the bullet after it emerges out hirizontally from the block will be

A. $160 \ \mathrm{ms}^{-1}$

B. $100 \ \mathrm{ms}^{-1}$

C. $80 \ \mathrm{ms}^{-1}$

D. $120 \ \mathrm{ms}^{-1}$

Answer: D

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6. A stationary body of mass 3 kg explodes into three equal pieces. Two of the pieces fly off at right angles to each other, one with a velocity $2\hat{i}$ m/s

and the other with a velocity $3\hat{j}$ m/s. If the explosion takes place in 10^{-5} s, the average force acting on the third piece in newton is

A. $\left(2\hat{i}+3\hat{j}\right)\times 10^{-5}$

B. $-\left(2\hat{i}+3\hat{j}\right)\times 10^{5}$

C. $(3j-2i)\times 10^{-5}$

D. $\left(2\hat{i}-3\hat{j}\right)\times 10^{-5}$

Answer: B

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7. The kinetic energy of a body of mass 4 kg and momentum 6 N-s will be

A. 4.5 J

B. 2.5 J

C. 5.5 J

D. 3.5 J

Answer: A

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8. Two bodies of masses m_1 and m_2 have same kinetic energy. The ratio of their momentum is

A. $m_1 : m_2$

B. $m_2 : m_1$

C. $\sqrt{m_1} : \sqrt{m_2}$

D. $m_1^2 : m_2^2$

Answer: C

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9. A stationary partical explodes into two partical of a masses m_1 and m_2 which move in opposite direction with velocities v_1 and v_2.

The ratio of their kinetic energies E_1 / E_2 is

A. $\frac{m_2}{m_1}$

B. $\frac{m_1}{m_2}$

C. $\frac{2m_2}{m_1}$

D. $\frac{2m_1}{m_2}$

Answer: A

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10. A 12 kg bomb at rest explodes into two pieces of 4 kg and 8 kg. If the momentum of 4 kg piece is 20 Ns, the kinetic energy of the 8 kg piece is

A. 25 J

B. 20 J

C. 50 J

D. 40 J

Answer: A

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11. A ball of mass m is moving towards a batsman at a speed v. The batsman strikes the ball and deflects it by an angle θ without changing its speed. The impulse imparted to the ball is given by

A. $mv\cos\theta$

B. $mv\sin\theta$

C. $2mv\cos\left(\frac{\theta}{2}\right)$

D. $2mv\sin\left(\frac{\theta}{2}\right)$

Answer: C

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12. A uniform force of $\left(3\hat{i}+\hat{j}\right)$ newton acts on a partical of mass $2kg$. Hence the partical is displaced from position $\left(2\hat{i}+\hat{k}\right)$ metre to possion $\left(4\hat{i}+3\hat{j}-\hat{k}\right)$ meters. The work done by the force on the partical is

A. 9 J

B. 6 J

C. 13 J

D. 15 J

Answer: A

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13. Force acting on a particle of mass m moving in straight line varies with the velocity of the particle as $F=K/V$ K is constant then speed of the particle in time t

A. $\frac{K}{v^2}t$

B. $\frac{2K}{v^2}t$

C. Kt

D. 2Kt

Answer: C

Watch Video Solution

14. A force $F_y = (3x + 2)\ \mathrm{N}$ is acting on a body. The work done by this force if it tends to displace the body from x = 0 m to x = 4 m will be

A. 32 J

B. 16 J

C. 0 J

D. $(12x + 8)\ \mathrm{J}$

Answer: C

Watch Video Solution

15. A body of mass $6kg$ is under a force which causes displacement in it given by $S = \frac{t^2}{4}$ maters where t is time . The work done by the force in 2 sec is

A. 12 J

B. 9 J

C. 6 J

D. 3 J

Answer: D

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16. The work done an a particle of mass m by a force

$$K\left[\frac{x}{\left(x^2+y^2\right)^{3/2}}\hat{i}+\frac{y}{\left(x^2+y^{2^{3/2}}\right)\hat{j}}\right](Kbe \in gacons\tan tofap \propto riate\ dir$$

(a,0) $\rightarrow$ $thep\oint$(0,a)` along a circular path of radius a about the origin in x - y plane is

A. $\frac{2K\pi}{a}$

B. $\frac{K\pi}{a}$

C. $\frac{K\pi}{2a}$

D. 0

Answer: D

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17. According to the work energy theorem, the work done by the net force on a particle is equal to the change in its

A. kinetic energy

B. potential energy

C. linear momentum

D. angular momentum

Answer: A

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18. A block of mass 10 kg, moving in x-direction with a constant speed of $10ms^{-1}$, is subjected to a retarding force $F = 0.1 \times J/m$ during its travel from x=20 m to 30 m. Its final KE will be

A. 475 J

B. 450 J

C. 275 J

D. 250 J

Answer: A

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19. A time dependent force $F = 6t$ acts on a particle of mass $1kg$. If the particle starts from rest, the work done by the force during the first $1\,\text{sec.}$ will be

A. 9 J

B. 18 J

C. 4.5 J

D. 22 J

Answer: C

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20. Consider a drop of rain water having mass 1 g falling from a height of $1km$. It hits the ground with a speed of $50m/s$ Take g constant with a volume $10m/s^2$. The work done by the

(i) gravitational force and the

(ii) resistive force of air is :

A. (i) -10 J (ii) -8.25 J

B. (i) 1.25 J (ii) -8.25 J

C. (i) 100 J (ii) 8.75 J

D. (i) 10 J (ii) -8.75 J

Answer: D

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21. A person trying to lose weight by burning fat filts a mass of $10kg$ upto a being of $1m1000$ time . Assume that the potential energy lost each time be lower the mass is dissipated . How much far will be use up considering the work done only when the weight is lifted up ? Far supplies $3.8 \times 10^7 J$ of energy per kg wich is canverted to mechanical energy with $x20\,\%$ efficiency rate Take $= 9.8ms^{-2}$

A. $6.75 \times 10^{-3}\text{kg}$

B. $9.89 \times 10^{-3}\text{kg}$

C. $12.89 \times 10^{-3}\text{kg}$

D. $2.45 \times 10^{-3}\ \text{kg}$

Answer: C

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Competitive Theinking 4 4 Elastic And Inelastic Collision

1. A bullet hits and gets embedded in a solid block resting on a frictionless surface. In this process, which of the following is correct ?

A. Only momentum is conserved

B. Only kinetic energy is conserved.

C. Neither momentum nor kinetic energy is conserved.

D. Both momentum and kinetic energy is conserved.

Answer: A

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2. In inelastic collision,

A. momentum, kinetic energy and total energy are conserved.

B. momentum, kinetic energy and total energy are not conserved.

C. momentum and kinetic energy are conserved but total energy are conserved but total energy is not conserved

D. total energy and momentum are conserved but kinetic energy is not conserved.

Answer: D

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3. A ball of mass M_1 collides elastically and head on with another ball of mass M_2 initially at rest . In which the following cases the transfer of momentum will be maximum?

A. $M_1 > M_2$

B. $M_1 = M_2$

C. $M_1 < M_2$

D. Data is insufficient to predict it.

Answer: B

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4. Two identiacal balls A and B having velocities of 0.5 m/s and $0.3 \ \mathrm{m/s}$ respectively collide elastically in one dimension. The velocities of B and A after the collision respectively will be

A. $0.3 \ \mathrm{m/s}$ and $0.5 \ \mathrm{m/s}$

B. $-0.5 \ \mathrm{m/s}$

C. $0.5 \ \mathrm{m/s}$ and $-0.3 \ \mathrm{m/s}$

D. $-0.3 \ \mathrm{m/s}$ and $0.5 \ \mathrm{m/s}$

Answer: C

Watch Video Solution

5. A bullet of mass 10 g moving with $300m/s$ hits a block of ice of mass 5 kg and drops dead. The velocity of ice is

A. $50 \ \mathrm{cm/s}$

B. $60 \ \mathrm{cm/s}$

C. $40 \ \mathrm{cm/s}$

D. $30 \ \mathrm{cm/s}$

Answer: B

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6. Two particles A and B, move with constant velocities $\overrightarrow{v_1}$ and $\overrightarrow{v_2}$. At the initial moment their position vectors are $\overrightarrow{r_1}$ and $\overrightarrow{r_2}$ respectively. The

condition for particle A and B for their collision is

A. $\vec{r_1} - \vec{r_2} = \vec{v_1} - \vec{v_2}$

B. $\frac{\vec{r_1} - \vec{r_2}}{\left|\vec{r_1} - \vec{r_2}\right|} = \frac{\vec{v_2} - \vec{v_1}}{\left|\vec{v_2} - \vec{v_1}\right|}$

C. $\vec{r_1}.\vec{v_1} = \vec{r_2}.\vec{v_2}$

D. $\vec{r_1} \times \vec{v_1} = \vec{r_2} \times \vec{v_2}$

Answer: B

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7. Two particles of masses m_1, m_2 move with initial velocities u_1 and u_2. On collision, one of the particles get excited to higher level, after absording enegry. If final velocities of particles be v_1 and v_2 then we must have

A. $m_1^2 u_1 + m_2^2 u_2 - \varepsilon = m_1^2 v_1 + m_2^2 v_2$

B. $\frac{1}{2} m_1 u_1^2 + \frac{1}{2} m_2 u_2^2 - \varepsilon = \frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2$

C. $\frac{1}{2}m_1u_1^2+\frac{1}{2}m_2u_2^2-\varepsilon=\frac{1}{2}m_1v_1^2+\frac{1}{2}m_2v_2^2$

D. $\frac{1}{2}m_1^2u_1^2+\frac{1}{2}m_2^2u_2^2+\varepsilon=\frac{1}{2}m_1^2v_1^2+\frac{1}{2}m_2^2v_2^2$

Answer: C

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8. Dimensional formula for coefficient of restitution

A. $\left[MLT^{-2}\right]$

B. $\left[M^0L^0T^0\right]$

C. $\left[MLT^{-1}\right]$

D. $\left[MT^{-2}\right]$

Answer: B

Watch Video Solution

9. A sphere of mass 'm' moving with velocity 'v' collides head-on on another sphere of same mass which is at rest. The ratio of final velocity of second sphere to the initial velocity of the first sphere is (e is coefficient of restitution and collision is inelastic)

A. $\frac{e-1}{2}$

B. $\frac{e}{2}$

C. $\frac{e+1}{2}$

D. e

Answer: C

Watch Video Solution

10. A moving block having mass m, collides with another stationary block having mass 4m. The lighter block comes to rest after collision. When the initial velocity of the lighter block is v, then the value of coefficient of restitution (e) will be

A. 0.5

B. 0.25

C. 0.8

D. 0.4

Answer: B

Watch Video Solution

11. A partical falls from a height h upon a fixed horizontal plane and rebounds. If e is the coefficient of restitution, the total distance travelled before rebounding has stopped is

A. $\frac{h(1+e^2)}{(1-e^2)}$

B. $\frac{h(1-e^2)}{(1+e^2)}$

C. $\frac{h(1-e^2)}{2(1+e^2)}$

D. $\frac{h(1+e^2)}{2(1-e^2)}$

Answer: A

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12. A small steel ball bounces on a steel plate held horizontally. On each bounce the speed of the ball arriving at the plate is reduced by a factor e (coefficient of restitution) in the rebound, so that $v_{\text{upward}} = eV_{\text{downward.}}$ If the ball is initially dropped from a height of 0.4 m above the plate and if 10 seconds later the bouncing ceases, the value of e is

A. $\sqrt{\frac{2}{7}}$

B. $\frac{3}{4}$

C. $\frac{13}{18}$

D. $\frac{17}{18}$

Answer: D

Watch Video Solution

13. A ball moving with velocity $2ms^{-1}$ collides head on with another stationary ball of double the mass. If the coefficient of restitution is 0.5, then their velocities (in ms^{-1}) after collision will be

A. 0, 1

B. 1, 1

C. 1, 0.5

D. 0, 2

Answer: A

Watch Video Solution

14. A ball is thrown vertically down from height of 40 m from the ground with an initial velocity 'v'. The ball hits the ground, loses $\frac{1}{3}rt$ of its total mechanical energy and rebounds back to the same height. If the acceleration due to gravity is 10 ms^{-2}, the value of 'v' is

A. $5\ \mathrm{ms}^{-1}$

B. $10 \ \mathrm{ms}^{-1}$

C. $15 \ \mathrm{ms}^{-1}$

D. $20 \ \mathrm{ms}^{-1}$

Answer: D

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15. A ball is thrown vertically downwards from a height of 20m with an intial velocity v_0. It collides with the ground, loses 50% of its energy in collision and rebounds to the same height. The intial velocity v_0 is (Take, g =10 ms^{-2})

A. $10 \ \mathrm{ms}^{-1}$

B. $14 \ \mathrm{ms}^{-1}$

C. $20 \ \mathrm{ms}^{-1}$

D. $28 \ \mathrm{ms}^{-1}$

Answer: C

Watch Video Solution

16. On a friction surface a block a mass M moving at speed v collides elastic with another block of same mass M which is initially at rest . After collision the first block moves at an angle θ to its initial direction and has a speed $\frac{v}{3}$. The second block's speed after the collision is

A. $\frac{\sqrt{3}}{2}v$

B. $\frac{2\sqrt{2}}{3}v$

C. $\frac{3}{4}v$

D. $\frac{3}{\sqrt{2}}v$

Answer: B

Watch Video Solution

17. In a collinear collision, a particle with an initial speed v0 strikes a stationary particle of the same mass. If the final total kinetic energy is 50% greater than the original kinetic energy, the magnitude of the relative velocity between the two particles, after collision, is :

A. $\frac{v_0}{2}$

B. $\frac{v_0}{\sqrt{2}}$

C. $\frac{v_0}{4}$

D. $\sqrt{2}v_0$

Answer: D

Watch Video Solution

18. A $100g$ iron ball having velocity $10m/s$ collies with a wall at an angle 30° and rebounds with the same angle. If the period of contact between the ball and wall is 0.1 second, then the force experinced by the wall is

A. 10 N

B. 100 N

C. 1.0 N

D. 0.1 N

Answer: A

Watch Video Solution

19. A ball moving with a momemtum 5 kg ms^{-1} strikes a wall. If the initial and final momenta make equal angles of 45°, then magnitude in change in momentum is

A. $5.05 \quad \mathrm{kg\,ms}^{-1}$

B. $7.07 \quad \mathrm{kg\,ms}^{-1}$

C. $10.00 \quad \mathrm{kg\,ms}^{-1}$

D. $0 \quad \mathrm{kg\,ms}^{-1}$

Answer: B

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20. A 1 kg ball moving with a speed of $6\ \mathrm{ms}^{-1}$ collides head - on with a 0.5 kg ball moving in the opposite direction with a speed of $9\ \mathrm{ms}^{-1}$. If the coefficient of restitution is $\frac{1}{3}$, the energy lost in the collision is

A. 303.4 J

B. 66.7 J

C. 33.3 J

D. 67.8 J

Answer: C

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21. A bullet of mass 4.2×10^{-2} kg, moving at speed of $300 \ \mathrm{ms}^{-1}$, gets stuck into a block with a mass 9 times that of the bullet. If the block is free to move without any kind of friction, the heat generated in the process will be

A. 45 cal

B. 405 cal

C. 450 cal

D. 1701 cal

Answer: B

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22. A particle of mass m moving in the x direction with speed 2v is hit by another particle of mass 2m moving in they y direction with speed v. If the collision is perfectly inelastic, the percentage loss in the energy during the collision is close to :

A. $44\ \%$

B. $50\ \%$

C. $56\ \%$

D. $62\ \%$

Answer: C

Watch Video Solution

23. Two bodies of masses 3 kg and 2 kg collide head-on. Their relative velocities before and after collision are 15 m/s and 5 m/s respectively. The loss of kinetic energy of the system is

A. 120 J

B. 100 J

C. 80 J

D. 240 J

Answer: A

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Competitive Theinking 4 5 Inertial And Non Inertial Frames

1. A reference frame attached to the earth

A. is an inertial frame by definition.

B. cannot be an inertial frame because earth is revloving round the sun.

C. is an inertial frame because Newton's laws are applicable.

D. is an inertial frame because the earth is rotating about its own axis.

Answer: B

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2. For ordinary terrestrial experimants, the observer is an inertial frame in the following cases is

A. A child revolving in a giant wheel

B. A driver in a sports car moving with a constant high speed of 200 kg h^{-1} on a straight road.

C. A cyclist negotiating a sharp curve.

D.

Answer: B

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Competitive Theinking 4 6 Moment Of Force

1. If $\overrightarrow{F}$ is the force acting in a particle having position vector $\overrightarrow{r}$ and $\overrightarrow{\tau}$ be the torque of this force about the origin, then

A. $\vec{r} . \vec{\tau} = 0$ and $\vec{F} . \vec{\tau} = 0$

B. $\vec{r} . \vec{\tau} \neq 0$ and $\vec{F} . \vec{\tau} \neq 0$

C. $\vec{r} . \vec{\tau} \neq 0$ and $\vec{F} . \vec{\tau} = 0$

D. $\vec{r} . \vec{\tau} \neq 0$ and $\vec{F} \times \vec{\tau} = 0$

Answer: A

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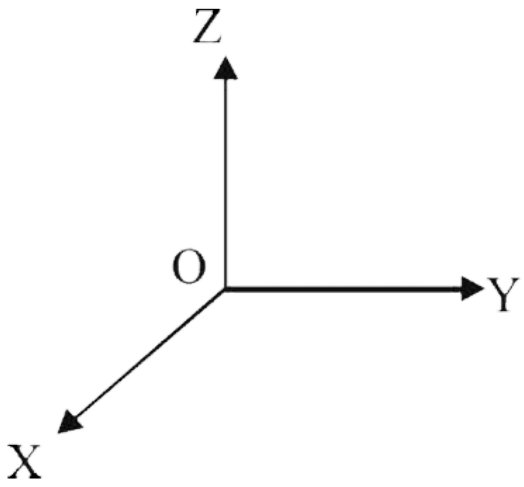
2. A force of $-F\hat{k}$ acts on O, the origin of the coodinate system. The torque about the point (1,-1) is



A. $-F\left(\hat{i}-\hat{j}\right)$

B. $F\left(\hat{i}+\hat{j}\right)$

C. $-F\left(\hat{i}-\hat{j}\right)$

D. $F\left(\hat{i}-\hat{j}\right)$

Answer: B

Watch Video Solution

3. A force $\overrightarrow{F}=4\hat{i}-5\hat{j}+3\hat{k}$ is acting a point $\overrightarrow{r_1}=\hat{i}+2\hat{j}+3\hat{k}$. The torque acting about a point $\overrightarrow{r_2}=3\hat{i}-2\hat{j}-3\hat{k}$ is

A. zero

B. $42\hat{i}-30\hat{j}+6\hat{k}$

C. $42\hat{i}+30\hat{j}+6\hat{k}$

D. $42\hat{i}+30\hat{j}-6\hat{k}$

Answer: D

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Competitive Theinking 4 7 Couple And Properties Of Couple

1. A couple produces.

A. purely linear motion.

B. purely rotational motion.

C. linear and rotational motion.

D. no motion.

Answer: B

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Competitive Theinking 4 8 Centre Of Mass

1. The centre of mass of a body

A. lies always outside the body.

B. may lie within, outside on the surface of the body.

C. lies always inside the body.

D. lies always on the surface of the body.

Answer: B

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2. Where will be the centre of mass on combining two masses m and $M(M > m)$?

A. Towards m

B. Towards M

C. Between m and M

D. Anywhere

Answer: B

Watch Video Solution

3. Two bodies of masses m_1 and m_2 are separated by a distance R. The distance of the centre of mass of the bodies from the mass m_1 is

A. $\frac{m_2 R}{m_1 + m_2}$

B. $\frac{m_1 R}{m_1 + m_2}$

C. $\frac{m_1 m_2}{m_1 + m_2} R$

D. $\frac{m_1 + m_2}{m_1} R$

Answer: A

Watch Video Solution

4. Three identicle particle each of mass $1kg$ are placed with their centres on a straight line. Their centres are marked A, B and C respectively. The

distance of centre of mass of the system from A is.

A. $\frac{AB + AC}{2}$

B. $\frac{AB + BC}{2}$

C. $\frac{AC - AB}{3}$

D. $\frac{AB + AC}{3}$

Answer: D

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5. Consider a sytem of two particles having masses m_1 and m_2. If the particle of mass m_1 is pushed towards the centre of mass of particles through a distance d, by what distance would the particle of mass m_2 move so as to keep the mass centre of particles at the original position?

A. $\frac{m_1}{m_1 + m_2} d$

B. d

C. $\frac{m_1}{m_2} = d$

D. $\frac{m_2}{m_1}d$

Answer: C

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6. The centre of mass of a system of three particles of masses 1 g, 2 g and 3 g is taken as the origin of a coordinate system. The position vector of a fourth particle of mass 4 g such that the centre of mass of the four particle system lies at the point $(1, 2, 3)$ is $\alpha\left(\hat{i} + 2\hat{j} + 3\hat{k}\right)$, where α is a constant. The value of α is

A. $\frac{10}{3}$

B. $\frac{5}{2}$

C. $\frac{1}{2}$

D. $\frac{2}{5}$

Answer: B

Watch Video Solution

7. Three particles of the same mass lie in the x-y plane. The (x,y) coordinates of their positions are (1,1),(2,2) and (3,3) respectively. The (x-y) coordinates of the centre of mass are:

A. (1, 2)

B. (2, 2)

C. (4, 2)

D. (6, 6)

Answer: B

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8. A loaded spring gun of mass M fires a bullet of mass m with a velocity v at an angle of elevation θ. The gun is initially at rest on a horizontal smooth surface. After firing, the centre of mass of the gun and bullet system

A. Moves with a velocity $\frac{v(M-m)}{M+m}$ in the horizontal direction

B. Moves with velocity $\frac{mv\cos\theta}{(M+m)}$

C. Moves with a velocity $v\left(\frac{m}{M+m}\right)$

D. Moves with a velocity $\left(\frac{mv\sin\theta}{M+m}\right)$

Answer: D

Watch Video Solution

9. Two blocks of masses 10 kg and 4 kg are connected by a spring of negligible mass and placed on a frictionless horizontal surface. An impulse gives a velocity of $14m/s$ to the heavier block in the direction of the lighter block. The velocity of the centre of mass is

A. 30 m/s

B. 20 m/s

C. 10 m/s

D. 5 m/s

Answer: C

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10. In the HCI molecule, the separation between the nuclei of the two atoms is about $1.27\text{Å}\left(1\text{Å} = 10^{-10}m\right)$. Find the approximate location of the c.m of the molecule, given that a chlorine atom is about 35.5 times as massive as a hydrogen atom and nearly all the mass of an atom is concentrated in its nucleus ?

A. 1Å

B. 2.5Å

C. 1.24Å

D. 1.5Å

Answer: C

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11. A 2 kg body and a 3 kg body are moving along the x-axis. At a particular instant the 2 kg body has a velocity of $3ms^{-1}$ and the 3 kg body has the velocity of $2ms^{-1}$. The velocity of the centre of mass at that instant is

A. $5 \ \mathrm{ms}^{-1}$

B. $1 \ \mathrm{ms}^{-1}$

C. 0

D. None of these

Answer: D

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12. A large number of particles are placed around the origin, each at a distance R from the origin. The distance of the center of mass of the system from the origin is

A. $= R$

B. $\leq R$

C. $> R$

D. $\geq R$

Answer: B

Watch Video Solution

13. The center of mass of a system of two particles divides the distance between them.

A. in inverse ratio of square of masses of particles.

B. in direct ratio of square of masses of particles.

C. in inverse ratio of masses of particles.

D. in direct ratio of masses of particles.

Answer: C

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14. A body A of mass M while falling wertically downwards under gravity brakes into two parts, a body B of mass $\frac{1}{3}$ M and a body C of mass $\frac{2}{3}$ M. The center of mass of bodies B and C taken together shifts compared to that of body A towards

A. body C.

B. body B.

C. depends on height of breaking.

D. does not shift.

Answer: D

Watch Video Solution

15. Two bodies of mass $1kg$ and $3kg$ have position vectors $\hat{i} + 2\hat{j} + \hat{k}$ and $-3\hat{i} - 2\hat{j} + \hat{k}$, respectively. The centre of mass of this system has a position vector.

A. $-2\hat{i}+2\hat{k}$

B. $-2\hat{i}-\hat{j}+\hat{k}$

C. $2\hat{i}-\hat{j}-\hat{k}$

D. $-\hat{i}+\hat{j}+\hat{k}$

Answer: B

Watch Video Solution

16. Centre of mass of 3 particles 10 kg, 20 kg and 30 kg is at (0, 0, 0). Where should a particle of mass 40 kg be placed so that the combination centre of mass will be at (3,3,3)

A. $(0, 0, 0)$

B. $(7.5, 7.5, 7.5)$

C. $(1, 2, 3)$

D. $(4, 4, 4)$

Answer: B

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17. Identify the correct statement for the rotational motion of a rigid body.

A. Individual particles of the body do not undergo accelerated motion.

B. The centre of mass of the body remains unchanged.

C. The centre of mass of the body moves uniformly in a circular path

D. Individual particles and centre of mass of the body undergo an accelerated motion.

Answer: B

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18. Distance of the centre of mass of a solid uniform cone from its vertex is z_0. It the radius of its base is R and its height is h then z_0 is equal to:

A. $\frac{h^2}{4R}$

B. $\frac{3h}{4}$

C. $\frac{5h}{8}$

D. $\frac{3h^2}{8R}$

Answer: B

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19. Determine the coordinates of the centre of mass of a right circular solid cone of base radius R and height h.

A. $\left(0, 0\frac{h}{4}\right)$

B. $\left(0, 0, \frac{h}{3}\right)$

C. $\left(0, 0, \frac{h}{2}\right)$

D. $\left(0, 0, \frac{3h}{8}\right)$

Answer: A

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Competitive Theinking 4 10 Conditions Of Equilibrium Of A Rigid Body

1. A rod of weight w is supported by two parallel knife edges A and B and is in equilibrium in a horizontal position. The knives are at a distance d from each other. The centre of mass of the rod is at distance x from A. The normal reaction on A is.. And on B is.....

A. $\frac{Wx}{d}$

B. $\frac{Wd}{x}$

C. $\frac{W(d-x)}{x}$

D. $\frac{W(d-x)}{d}$

Answer: D

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Competitive Theinking Miscellaneous

1. Which of following statements are correct ? ltbgt (a) Centre of mass of a body always coincides with the centre of gravity of the body

(b) Central of mass of a body is the point at which the total garvitational torque on the body is zero

(c) Couple on a body produces both trasnlational and rotation motion in a body

(d) Mechinical advantage greater than one means that small efforts can be used to lift a large load

A. (b) and (d)

B. (a) and (b)

C. (b) and (c)

D. (c) and (d)

Answer: A

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2. n balls each of mass m impinge elastically each second on a surface with velocity u. The average force experienced by the surface will be

A. mnu

B. 2mun

C. 4mun

D. $\frac{1}{2}m\nu$

Answer: B

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3. A block of mass 1 kg starts from rest at x = 0 and moves along the X - axis under the action of a force F = kt, where t is time and $k = 1 \ \mathrm{Ns}^{-1}$.

The distance, the block will travel in 6 seconds is

A. 36 m

B. 72 m

C. 108 m

D. 18 m

Answer: A

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4. A body of mass 3 kg moving with a velocity $\left(2\hat{i}+3\hat{j}+3\hat{k}\right)$ m/s collides with another body of mass 4 kg moving with a velocity $\left(3\hat{i}+2\hat{j}-3\hat{k}\right)$ m/s. The two bodies stick together after collision. The velocity of the composite body is

A. $\frac{1}{7}\left(4\hat{i}+6\hat{j}-3\hat{k}\right)$

B. $\frac{1}{7}\left(18\hat{i}+17\hat{j}-3\hat{k}\right)$

C. $\frac{1}{7}\left(6\hat{i}+4\hat{j}-6\hat{k}\right)$

D. $\frac{1}{7}\left(9\hat{i}+8\hat{j}-6\hat{k}\right)$

Answer: B

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5. A particle moves in the xy plane under the influence of a force such that its linear momentum is $\vec{P}(t)=A\left[\hat{i}\cos(kt)-\hat{j}\sin(kt)\right]$, where A and k are constants. The angle between the force and momentum is

A. 0°

B. 30°

C. 45°

D. 90°

Answer: D

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6. A particle of mass m is projected from the ground with an initial speed u_0 at an angle α with the horizontal. At the highest point of its trajectory, it makes a completely inelastic collision with another identical particle, which was thrown vertically upward from the ground with the same initial speed u_0. The angle that the composite system makes with the horizontal immediately after the collision is

A. $\frac{\pi}{4}$

B. $\frac{\pi}{4} + \alpha$

C. $\frac{\pi}{4} - \alpha$

D. $\frac{\pi}{2}$

Answer: A

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7. A balloon with mass m is descending down with an acceleration a $(wherea < g)$. How much mass should be removed from it so that it starts moving up with an acceleration a?

A. $\frac{2ma}{g+a}$

B. $\frac{2ma}{g-a}$

C. $\frac{ma}{g+a}$

D. $\frac{ma}{g-a}$

Answer: A

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8. A plumb line is suspended from a ceiling of a car moving with horizontal acceleration of a . What will be the angle of inclination with vertical

A. $\tan^{-1}(a/g)$

B. $\tan^{-1}(g/a)$

C. $\cos^{-1}(a/g)$

D. $\cos^{-1}(g/a)$

Answer: A

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9. A body of mass 10 kg is upon by a force given by equation $F = \left(3t^2 - 30\right)$ newtons. The initial velocity of the body is 10 m/s. The velocity of the body after 5 sec. is

A. 4.5 m/s

B. 6 m/s

C. 7.5 m/s

D. 5 m/s

Answer: C

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10. The velocity (v) of a particle (under a force F) depends on its distance (x) from the origin (with $x > 0$) $v \propto \frac{1}{\sqrt{x}}$. Find how the magnitude of the force (F) on the particle depends on x.

A. $F \propto \frac{1}{x^{\frac{3}{2}}}$

B. $F \propto \frac{1}{x}$

C. $F \propto \frac{1}{x^2}$

D. $F \propto x$

Answer: C

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11. A body of mass $m = 10^{-2} kg$ is moving in a medium and experiences a frictional force $F = -Kv^2$. Its initial speed is $v_0 = 10ms^{-2}$. If , after $10s$, its energy is $\frac{1}{8}mv_0^2$, the value of k will be

A. 10^{-4} $\mathrm{kg\,m^{-1}}$

B. $10^{-1}\ \mathrm{kg\,m^{-1}}s^{-1}$

C. $10^{-3}\ \mathrm{kg\,m^{-1}}$

D. $10^{-3}\ \mathrm{kg\,s^{-1}}$

Answer: A

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12. A light string passing over a smooth light pulley connects two blocks of masses m_1 and m_2 (vertically). If the acceleration of the system is $g/8$, then the ratio of the masses is

A. $8:1$

B. $9:7$

C. $4:3$

D. $5:3$

Answer: B

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13. A body of mass $m = 3.513kg$ is moving along the x-axis with a speed of $5.00ms^{-1}$. The magnetude of its momentum is recorded as

A. $17.565 \ \text{kg m s}^{-1}$

B. $17.56 \ \text{kg m s}^{-1}$

C. $17.57 \ \text{kg m s}^{-1}$

D. $17.6 \ \text{kg m s}^{-1}$

Answer: D

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14. A nucleus of uranium decays at rest into nuclei of thorium and helium.

Then :

A. the helium nucleus has less kinetic energy than the thorium nucleus.

B. the helium has more kinetic energy than the thorium nucleus.

C. the helium nucleus has less momentum than the thorium nucleus.

D. the helium nucleus has more momentum than the thorium nucleus.

Answer: B

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15. Two spherical bodies of mass M and 5M & radii R & 2R respectively are released in free space with initial separation between their centres equal to 12R. If they attract each other due to gravitational force only, then the distance covered by the smallar body just before collision is

A. 2.5 R

B. 4.5 R

C. 7.5 R

D. 1.5 R

Answer: C

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16. A ball is released from the top of a tower. The ratio of work done by force of gravity in 1st second, 2nd second and 3rd second of the motion of ball is

A. $1:3:5$

B. $1:4:25$

C. $1:9:25$

D. $1:2:3$

Answer: A

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17. Hammer of mass M strikes a nail of mass 'm' with a velocity 20 m/s into a fixed wall. The nail penetrates into the wall to a depth of 1 cm. The average resistance of the wall to the penetration of the nail is

A. $\left(\frac{M^2}{M+m}\right) \times 10^3$

B. $\frac{2M^2}{M+m} \times 10^4$

C. $\frac{M+m}{M^2} \times 10^2$

D. $\frac{M^2}{M+m} \times 10^2$

Answer: B

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18. Two paricle A and B initially at rest, move towards each other under mutual force of attraction. At the instant when the speed of A is V and the speed of B is 2V, the speed of the centre of mass of the system is

A. Zero

B. v

C. $\frac{3v}{2}$

D. $-\frac{3v}{2}$

Answer: A

Watch Video Solution

19. Two particles of equal mass have velocities $\vec{v}_1 = 2\hat{i} = m/s^{-1}$ and $\vec{v}_2 = 2\hat{j}m/s^{-1}$. First particle has an acceleration $\vec{a}_1 = \left(3\hat{i} + 3\hat{j}\right)ms^{-2}$ while the acceleration of the other particle is zero. The centre of mass of the two particles moves in a path of.

A. circle

B. parabola

C. ellipse

D. straight line

Answer: D

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20. Assertion : If there is no external torque on a body about its centre of mass, then the velocity of the centre of mass remains constant.

Reason : The linear momentum of an isolated system remains constant.

A. Assertion is True, Reason is True, Reason is a correct explanation for Assertion

B. Assertion is True, Reason is True, Reason is not a correct explanation for Assertion

C. Assertion is True, Reason is False

D. Assertion is False, Reason is False.

Answer: D

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21. Assertion:A table cloth can be pulled from a table without dislodging the dishes.

Reason: To every action there is an equal and opposite reaction.

A. Assertion is True, Reason is True, Reason is a correct explanation for Assertion

B. Assertion is True, Reason is True, Reason is not a correct explanation for Assertion

C. Assertion is True, Reason is False

D. Assertion is False, Reason is False.

Answer: B

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22. A body of mass (4m) is laying in xy-plane at rest. It suddenly explodes into three pieces. Two pieces each mass (m) move perpedicular to each

other with equal speeds (v). Total kinetic energy generated due to explosion is

A. mv^2

B. $\frac{3}{2}mv^2$

C. $2\ \mathrm{mv}^2$

D. $4\ \mathrm{mv}^2$

Answer: B

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23. A partical of mass m is driven by a machine that deleveres a constant power k watts. If the partical starts from rest the force on the partical at time t is

A. $\sqrt{\frac{mk}{2}}t^{-\frac{1}{2}}$

B. $\sqrt{mk}t^{\frac{-1}{2}}$

C. $\sqrt{2mk}t^{\frac{-1}{2}}$

D. $\frac{1}{2}\sqrt{mkt}^{\frac{-1}{2}}$

Answer: A

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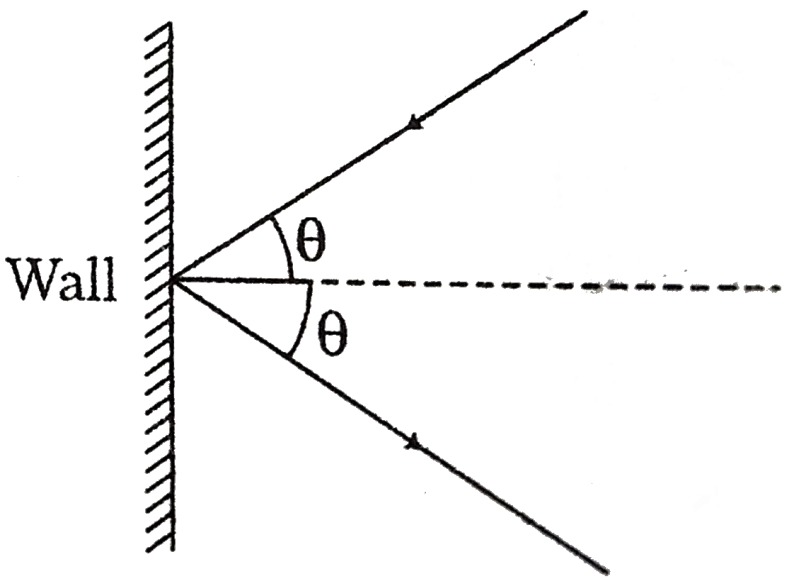
24. The mass of hydrogen molecule is 3.32×10^{-27} kg. If 10^{23} hydrogen molecules strick per second at 2 cm^2 area of a rigid wall at an angle of 45° from the normal and rebound back with a speed of 1000 ms^{-1}, then the pressure exerted on the wall is



A. $2.35 \times 10^7 \ \mathrm{N/m^2}$

B. $4.70 \times 10^2 \ \mathrm{N/m^2}$

C. $2.35 \times 10^3 \ \mathrm{N/m^2}$

D. $4.70 \times 10^3 \ \mathrm{N/m^2}$

Answer: C

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25. A lift weighing 250 kg is to be lifted up at a constant velocity of 0.20 m. What would be the minimum horse power of the motor to be used ?

A. 1.3 hp

B. 0.65 hp

C. 1.5 hp

D. 0.75 hp

Answer: B

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26. It is found that if a neutron suffers an elastic collinear collision with deuterium at rest, fractional loss of its energy is p_d, while for its similar collision with carbon nucleus at rest, fractional loss of energy is p_c. The values of p_d and p_c are respectively :

A. (0, 0)

B. (0, 1)

C. (0.89, 0.28)

D. (0.28, 0.89)

Answer: C

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Evaluation Test

1. A hammer og mass M falls from height h to drive a pile of mass m into the ground. The hammer makes the pile pentrate in the ground to a distance d, opposition force of penetration is given by -

A. $\frac{m_1^2gh}{(m_1+m_2)d}+(m_2+m_1)g$

B. $(m_1+m_2)gd$

C. $\frac{m_1^2gh}{(m_1+m_2)d}$

D. $\frac{m_1^2gh}{(m_1+2m_2)d}+(2m_2+m_1)g$

Answer: A

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2. The momentum of a body of mass 8 kg is 20 kg m/s. A force of 12 N acts on the body in the direction of motion for 4 s, the increase in the kinetic energy is

A. 398 J

B. 264 J

C. 113 J

D. 75.5 J

Answer: B

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3. A 1 kg ball moving with a speed of 20 m/s strikes a hard wall at an angle of 30° with the wall. It is reflected with the same speed at the same angle. If the ball is in contact with the wall for 0.5 seconds, the average force acting on the wall is

A. 96 N

B. 48 N

C. 24 N

D. 40 N

Answer: D

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4. A particle moves in the xy plane under the influence of a force such that its linear momentum is $\overrightarrow{P}(t) = A\left[\hat{i}\cos(kt) - \hat{j}\sin(kt)\right]$, where A and k are constants. The angle between the force and momentum is

A. 0°

B. 30°

C. 45°

D. 90°

Answer: D

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5. Consider a two particle system with particles having masses m_1 and m_2 if the first particle is pushed towards the centre of mass through a distance d, by what distance should the second particle is moved, so as to keep the center of mass at the same position?

A. d

B. $\sqrt{2}d$

C. $\frac{m_1}{m_2}d$

D. $\frac{m_2}{m_1}d$

Answer: C

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6. Two balls of masses 4 g and 10 g are moving with kinetic energies in the ratio of 5 : 2. What is the ratio of their linear momenta ?

A. $1:1$

B. $2:1$

C. $1:2$

D. $3:1$

Answer: A

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7. A rope of mass 0.2 kg is connected at the same height of two opposite walls. It is allowed to hang under its own weight. At the contact point between the rope and the wall, the rope makes an angle $\theta = 30\,\%^{\circ}$ with respect to horizontal. The tension in the rope at its midpoint between the walls is

A. 1.78 N

B. 1.56 N

C. 1.82 N

D. 1.96 N

Answer: D

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8. A body of mass 4m is split into two equal parts by an internal explosion which generates a kinetic energy E. If, after the explosion, the parts move in the same line as before, then what is their relative speed?

A. $\sqrt{E/m}$

B. $\sqrt{2E/m}$

C. $\sqrt{4E/m}$

D. 0

Answer: B

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9. Statement-1 : The centre of mass of a body may lie where there is no mass.

Statement-2 : The centre of mass has nothing to do with the mass.

A. Assertion is True, Reason is True, Reason is a correct explanation for Assertion

B. Assertion is True, Reason is True, Reason is not a correct explanation for Assertion

C. Assertion is True, Reason is False

D. Assertion is False, Reason is False.

Answer: C

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10. Particle A makes a perfectly elastic collision with anther particle B at rest. They fly apart in opposite direction with equal speeds. If the masses

are $m_A \& m_B$ respectively, then

A. $1:3$

B. $1:1$

C. $1:\sqrt{3}$

D. $\sqrt{3}:1$

Answer: A

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11. Assertion: For the object moving on the earth, earth is non-inertial frame of reference.

Reason: Newton's first law of motion does hot hold good for the earth.

A. Assertion is True, Reason is True, Reason is a correct explanation for Assertion

B. Assertion is True, Reason is True, Reason is not a correct explanation for Assertion

C. Assertion is True, Reason is False

D. Assertion is False, Reason is False.

Answer: D

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12. An explosion blows a rock into three parts. Two parts go off at right angles to each other . These two are $1kg$ first part moving with a velocity of $12ms^{-1}$ and $2kg$ second part moving with a velocity of $8ms^{-1}$. If the third part flies off with a velocity of $4ms^{-1}$. Its mass would be

A. 7 kg

B. 4 kg

C. 3 kg

D. 5 kg

Answer: B

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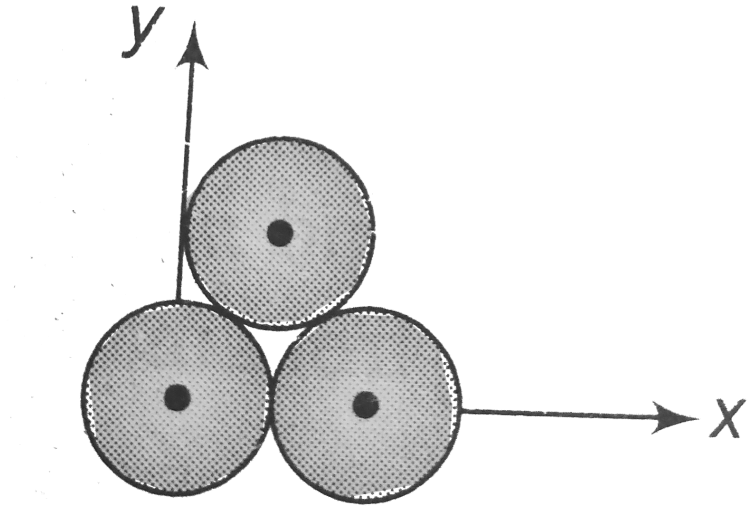
13. Three identical spheres each of radius R are placed thouching each other on a horizontal table as shown in figure. The co-ordinates of centre of mass are :



A. r, r

B. $r/\sqrt{3}, r/\sqrt{3}$

C. $r, r/\sqrt{3}$

D. $\frac{r}{2}, \frac{r}{\sqrt{3}}$

Answer: C

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14. A circket ball of mass m is bowled at a batsman and gets to the bat travelling at v m/s. The batsman hits the ball and it leaves his bat after t seconds at a speed of v/2 m/s. The magnitude of the force on the ball in newtons is

A. $\frac{mv}{2t}$

B. $\frac{2m}{3vt}$

C. $\frac{2mv}{t}$

D. $\frac{3mv}{2t}$

Answer: D

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15. Two glass balls, two ivory balls, two cork balls, two cast iron balls, two lead balls collide.

A. Coefficient of restitution is maximum for glass balls.

B. Coefficient of restitution is maximum for ivory balls.

C. Coefficient of restitution is maximum for lead balls.

D. Coefficient of restitution is least for cork balls.

Answer: A

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16. A hollow metallic bob is filled with a liquid. A small hole is drilled just below the centre of gravity of bob so that liquid slowly drops out of it. Water drops out continuously and the bob gets empty of liquid. In this entire process C.G.

A. remains at the centre of the bob throughout.

B. first shifts downwards from centre of the bob, then upwards and returns back to centre when the bob gets completely empty.

C. first shifts upwards from centre of the bob, then downwards and returns back to centre when the bob gets completely empty.

D. keeps moving upward and downward periodically.

Answer: B