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CBSE Board
Class XI Physics
Sample Paper – 7

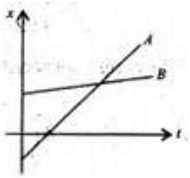
Q1. Which of the following statements is false for a particle moving in a circle with a constant angular speed?

(a) The velocity vector is tangent to the circle
(b) The acceleration vector is tangent to the circle
(c) the acceleration vector points to-the centre of the circle
(d) the velocity and acceleration vectors are perpendicular to each other

Sol. (b)

The acceleration vector acts 1ong the radius of the circle. The given statement is false.

Q2. Figure shows the time- displacement graph of the particles A and B. Which of the following statements is correct?



(a) Both A and B move with uniform equal speed.
(b) A is accelerated, B is retarded
(c) Both A and B move with uniform speed. The speed of B is more than the speed of
(d) Both A and B move with uniform speeds but the speed of A is more than the speed of B.

Sol. (d)

As both the curves have a constant slope or dt/dx their speeds are constant $(slope)^A >$ $(slope)\ B^{bv}A^vB$.

Q3. The force exerted by the floor of an elevator on the foot of a person standing there is more than the weight of the person if the elevator is

(a) going up and slowing down.
(b) going up and speeding up
(c) going down and slowing down
(d) ping down and speeding up.

Sol. (b)

When the lift is accelerated upwards: suppose R be the upward thrust of the floor on the man and mg is the weight of the man acting downwards. R-mg=ma = R=m(a + g)

Thus, in this case force exerted by the floor of an elevator on the foot of a person is more than the weight of the person.

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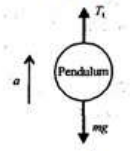
Q4. The question contains statement-1(Assertion) and Statement-2(Reason), the question has four choices. You have to select the correct choice.
Assertion : The value of dynamic friction is less than the limiting friction.
Reason : Once the motion has started, the inertia of rest has been overcome.
(a) if statement-1 is true but statement-2 is fuse
(b) if statemnt-1 is false and statement.2 is true
(c) if both statement-1 and statement-2 are true and statement-2 is the correct explanation of statement-1
(d) if both statement-1 andstatement-2 are true but statement2 is not the correct explanation of statement-1

Sol. (d)
Once the bodies are in motion the irregularities do not get time enough to interlock hence motion continues with lesser friction. Also the force exerted initially
(i) accelerates the body (ii) overcomes friction
Only function (ii) is relevant for a moving body so apparent force is reduced.

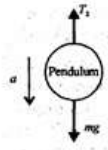
Q5. A pendulum is hanging from the ceiling o. a cage. If the cage moves up with constant acceleration a, its tension is T_1. If it moves down with the same acceleration a then the tension is T_2. If the cage moves horizontally with the same acceleration a, then the tension is T. Now, $2T^2$ =
(a) $T_1^2\ T_2$
(b) $T_1^2 . 2T_2$
(c) $2T^2\ T_2$
(d) T_1^2

Sol. (a)

Detailed Answer::



$T_1 mg\ ma \Rightarrow T_1\ m\ (g\ a)$ ...(1)



$mg\ T_2\ ma \Rightarrow T_2\ m(g\ a)$ ...(2)

When the pendulum accelerates sideways,
$T \sin ma$
$T \cos mg$

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$\Rightarrow \sin = \frac{ma}{\text{and}} \quad \cos = \frac{mg}{}$ —

$\sin^2 \cos^2 = \frac{m^2a^2 \quad m^2g^2}{}$

or $T^2 \quad (ma)^2 \quad (mg)^2$ ... (3)

From (1) (2), $T_1 \quad T_2 \quad 2mg$ or

$mg = \frac{(T_1 \quad T_2)}{}$

For (1) (2), $T_1 \quad T_2 \quad 2mg$ or

$ma = \frac{(T_1 \quad T_2)}{}$

Hence (3) becomes

$$= \frac{\left(\frac{T_1 \quad T_2}{2}\right)^2 \quad \left(\frac{T_1 \quad T_2}{2}\right)^2}{}$$

$T^2 = \frac{2T_1^2 \quad 2T_2^2}{}$

Or $2T^2 \quad T_1^2 \quad T_2^2$.

Q6. A helicopter of mass 1000 kg rises with a vertical acceleration of 15 ms^{-2}. The crew and the passengers weigh 300 kg. The magnitude or the action of the rotor of the helicopter on the surrounding air is

(a) $2 \times 10^3 N$
(b) $3.25 \times 10^4 N$
(c) $3.5 \times 10^4 N$
(d) $7.5 \times 10^3 N$

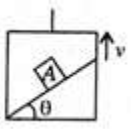
Sol. (b)

The required action is equal and opposite to the force on the helicopter due to the surrounding air. Fmg ma

F m(ga)

$(1000kg \; 300kg)(10ms^2 \; 15ms^2) \; (1300)(25)N \; 3.25x10^4 \; N.$

Q7. A block 4 is able to slide on the frictionless incline of angle q and length ***l***, kept inside an elevator going up with uniform velocity v. Find the time taken by the block to slide down the length of the incline if released from rest. What would be the time taken if the elevator is accelerated at a ms^{-2}.



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(a) $\sqrt{\frac{2l}{g\ sin}}$ $\sqrt{\frac{2l}{(ga)sin}}$

(b) $\sqrt{\frac{2l}{g\ sin}}$ $\sqrt{\frac{2l}{(g\ a\ )cos}}$

(c) $\sqrt{\frac{2l}{g\ sin}}$ $\sqrt{\frac{2l}{g\sin t}}$

(d) None of these

Sol. (a)

Case (i):

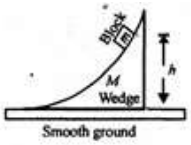
$\frac{1}{2}g\sin t^2\ \ l\ \ or\ \ t$ $\sqrt{\frac{2l}{g\sin}}$

Case (ii)

$\frac{1}{2}(g\ a)\sin t^2\ \ l\ \ or\ \ t$ $\sqrt{\frac{2l}{(g\ a)\sin}}$

Q8. Read the passage and answer the question below:

A block of mass m slides down a wedge of mass M as shown. The whole system is at rest, when the height of the block is h above the ground. The wedge surface is smooth and gradually flattens. There is no friction between wedge and ground.



If there is no friction anywhere, the speed of the wedge, as the block leaves the wedge, is n times (2gh)*0.5 So "n" is

(a) $(m^2/M(M+m))*0.5$
(b) $(M^2/M(M+m))*0.5$
(c) m/(M+m)
(d) M/(M+m)

Sol. (a)

Q9. A block of mass m = 1 kg, moving on a horizontal surface with speed u1 = 2 ms^{-1} enters a rough patch ranging from x = 0.10 m to x = 2.01 m. The retarding force Fr on the block in this range is
F kx for 0.1 x 2.01 m,
0 for x 0.1 m and x 2.01 m
Where k = 0.5 J
The final kinetic energy of the block is : (given In 20.1>> 3)

(a) 0.5 J

(b) 1 J

(c) 1.5 J

(d) 2J

Sol. (a)

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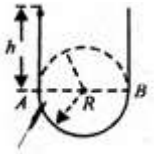
Q10. The question contains statement-I (Assertion) and Statement-2 (Reason). The question has four choices. You have to select the correct choice.
Assertion : A light body and heavy body have same momentum. Then they also have same kinetic energy.
Reason : Kinetic energy depends on mass of the body.
(a) if statement-1 is true but statement-2 is false
(b) if statement-1 is false and statement-2 is true.
(c) if both statement-1 and statement-2 are true and statement-2 is the correct explanation of statement-1
(d) if both statement-1 and statement-2 are true but statement-2 is not the correct explanation of statement-1

Sol. (b)

Q11. Read the passage and answer the question below:

A 'U' shaped smooth wire has a smooth semi-circular bend between A and B as shown. A of mass m is released from a height h on one side of wire above point A and it reaches same height on other side. The speed of particle between A and remains constant (h >> R)



Change in magnitude of velocity of bead between point A and B is
(a) $(2gh) * 0.5$
(b) $(4gh) * 0.5$
(c) $(8gh) * 0.5$
(d) 0

Sol. (d)

Q12. A bomb of mass M at rest explodes into two fragments of masses m_1 and m_2. The total energy released in the explosion is E. If E_1 and E_2 represent the energies carried by masses m_1 and m_2 respectively, then which of the following is correct?
(a) $E_1 = (m_2/M)\ E$
(b) $E_1 = (m_1/m_2)\ E$
(c) $E_1 = (m_1/M)\ E$
(d) $E_1 = (m_2/\ m_{1)}\ E$

Sol. (a)

Q13. A rope of length 30 cm is on a horizontal table with maximum length hanging from edge A of the table. The coefficient of friction between the rope and table is 0.5. The distance of centre of mass of the rope from A is,then what is 3A:

(a) $5\sqrt{15}\ cm$
(b) $5\sqrt{17}$ cm

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(c) $5\sqrt{19}\ cm$
(d) $7\sqrt{17}$ cm

Sol. (b)

Q14. In equilibrium, the potassium (39) and iodine (127) atoms of Kl are separated by approximately 3Aº. The centre of mass of Kl from potassium is
(a) 1.2 A°
(b) 2.13 A°
(c) 2.28 A°
(d) 1.8A°

Sol. (c)

Q15. A force of 15N is acting on a particle of mass 3kg towards north and a force of 20N is acting on another particle of mass 2kg towards east. The acceleration of the centre of mass of the two particle system is
(a) 7 m/s^2
(b) 5 m/s^2
(c) 1 m/s^2
(d) Zero

Sol. (b)
$F = Ma_{cm}$
$\sqrt{15^2 + 20^2} = 5(a_{cm})$

Q16. Starting with the same initial conditions an ideal gas expands from volume V_1 to V_2 in three different ways. The work done by the gas is W_1 if the process is purely isothermal, W_2 if purely isobaric and W_3 if purely adiabatic, then
(A) $W_2 > W_1 > W_3$
(B) $W_2 > W_3 > W_1$
(C) $W_1 > W_2 > W_3$
(D) $W_1 > W_3 > W_2$

Sol. (A)

Q17. It is hotter for the same distance over the top of the fire than it is in the side of it mainly because
(A) heat is radiated upward
(B) air conducts heat upward
(C) convection takes more heat upward
(D) conduction,convection and radiation all contribute significantly transferring heat upward

Sol. (C)

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Q18. Carnot cycle is
(A) reversible
(B) irreversible
(C) (1) or (2) depending upon conditions
(D) the least efficient

Sol. (A)

Q19. One of the following is wrong
(A) Two shirts are warmer than one of the same material but of double thickness
(B) Wool is a bad conductor of heat
(C) Glass is a good conductor of heat
(D) Heat radiations have very high velocity

Sol. (C)

Q20. The increase in entropy when 1 kg of ice melts into water without change in temperature (latent heat of fusion = 3.36×10^5 J/Kg) is
(A) 1.92×10^3 J/K
(B) 12.3×10^3 J/K
(C) $2.8 \times l6^3$ J/K
(D) 1.23×10^3 J/K

Sol. (D)

Q21. Four identical pieces of copper are painted with different types of paints. Which one do you expect to lose heat most rapidly if they are all heated to the same temperature and allowed to cool in vaccum
(A) A piece painted rough white
(B) painted rough black
(C) painted shiny white
(D) painted shiny black

Sol. (B)

Q22. A tuning fork of unknown frequency gives 4 beats / second with a tuning fork of frequency 310Hz. When the fork is filed the number of beats remains unchanged. The unknown frequency is
(A) 312 Hz
(B) 314 Hz
(C) 306 Hz
(D) 310 Hz

Sol. (D)

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Q23. A tuning fork A produces 4 beats/s with another tuning fork B of frequency 256 cps. On tiling the fork A, only 2 beats are heard/s. Frequency of fork A before filing is
(A) 252
(B) 254
(C) 260
(D) 272

Sol. (A)

Q24. The maximum tolerable sound intensity in dB is
(A) 100 dB
(B) 200 dB
(C) 120 dB
(D) 10 dB

Sol. (c)

Q25. As a transverse wave strikes against a wall
(A) its phase changes by 180º, but velocity does not change
(B) its phase does not change, but velocity changes
(C) its velocity changes and phase too changes by 180º
(D) nothing can be predicted about changes in its velocity and phase

Sol. (A)
Phase change of occur for reflection at denser (fixed) point.

Q26. Two wires of radii r and 2r respectively are welded together end to end. This combination is used as a sonometer wire and is kept under tension T. The welded point is midway between the two bridges. The ratio of number of loops formed in the wires such that the joint is a node when stationary vibrations are set up is
(A) 1 : 1
(B) 2 : 1
(C) 1 : 2
(D) 4 : 1

Sol. (c)

Q27. Intensity of sunlight transmitted by a window of area 1 m^2 is 840 W/m^2. If the angle between sun's rays & normal to the window is 60°, the power in the room is
(A) 360 W
(B) 400 W
(C) 420W
(D) 510W

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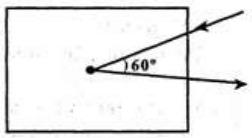
Sol. (C)



$$\text{Intensity} \quad \frac{\text{Power in the room}}{r}$$

$$\frac{\text{Power}}{ds \times \cos 60^{o}} \quad ds \; 1m^{2}$$

$$\text{Power} \quad 840 \times \frac{}{2} \; 420 \text{ W}$$

Q28. If the velocity of sound in air is 320 ms^{-1}, the frequency of the fundamental note emitted by a tube of length 1 m closed at one end is
(A) 80 Hz
(B) 240 Hz
(C) 320 Hz
(D) 400 Hz

Sol. (A)

Q29. One gram of water on evaporation at atmospheric pressure forms 1671 cm_3 of steam. Heat of vaporisation at this pressure is 540 cal gm^{-1}. The increase in internal energy is
(A) 250cal
(B) 500cal
(C) 1000cal
(D) 1500cal

Sol. (B)

$$dQ = du+dw$$
$$mL = du+pdv$$
$$du = mL-pdv$$

Q30. Newton's Laws of Motion discuss
(A) the cause of motion
(B) motion of the object
(C) energy associated with object
(D) none of these

Sol. (A)