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CBSE Board
Class XI Physics
Sample Paper – 8

Q1. The SI unit of electric field strength is

(A) newton $(coulomb)^{-1}$

(B) newton $(ampere)^{-1}$

(C) volt $(coulomb)^{-1}$

(D) joule $(coulomb)^{-1}$

Sol. (A)

Q2. Rain is falling vertically with a speed of 35 ms^{-1}. A woman rides a bicycle with a speed of 12 ms^{-1} in east to west direction. The direction in which she should hold her umbrella

(A) theta = $\tan^{-1}(12/35)$ with vertical towards east

(B) theta = $\tan^{-1}(12/35)$ with vertical towards west

(C) theta = $\tan^{-1}(12/37)$ with vertical towards north

(D) theta = $\tan^{-1}(12/37)$ with vertical towards south

Sol. (B)

Q3. A body is projected at an angle a to the horizontal so as to c1eir two walls of equal height h at a distance 2h from each other. The horizontal range of the projectile is:

(A) h cos(a/2)

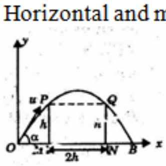
(B) $\frac{h}{2}\sin^2 a$

(C) 2h sin 2a

(D) 2h cot (a/2)

Sol. (D)

The projected body has projectile motion, which can be supposed to be made of two simple motion i.e., motion in
Horizontal and motion in vertical direction.



The point of projection O, is the origin, the horizontal line through O in the plane of the motion is the x-axis and the vertical line through O is the y-axis. PM& QN are two walls, just clear by projectile. The equation of trajectory of the particle is,

$$y = x\tan a - \frac{1}{2} g \frac{x^2}{u^2\cos^2 a} \quad ...(i)$$

Since the projectile just clears the two walls PM and QN each of height h, the y-coordinate of points P & Q must satisfying equation (1), i.e.,

$$h = x\tan a - \frac{1}{2} g \frac{x^2}{u^2\cos^2 a}$$

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Or $gx^2 - 2u^2 x \sin\alpha\cos\alpha + 2hu^2\cos^2\alpha = 0$ ...(2)

Let x_1 and x_2 be the x-coordinates of points P and Q. Then x_1 and x_2 are the roots of quadratic equation (2).

Comparing equation (2) with $ax^2 + bx + c = 0$, we Find,

$$x_1 + x_2 = -\frac{b}{a} = \frac{2u^2\sin\alpha\cos\alpha}{g} \quad ...(3)$$

$$and\ x_1x_2 = \frac{c}{a} = \frac{2hu^2\cos^2\alpha}{g} \quad ..(4)$$

Let R be the range of the projectile, i.e, let OB = R. From the symmetry of the path about the axis of the parabola, we have,

NB = OM = x_1

$\therefore$ R = OB = ON + NB = $x_2 + x_1$

From (3), $R = \frac{2u^2\sin\alpha\cos\alpha}{g}$ ...

Distance between the walls = 2h = $x_2 - x_1$

Squaring, $4h^2 = (x_2 - x_1)^2 = (x_2 + x_1)^2 - 4x_1x_2$

$$4h^2 = R^2 - \frac{8hu^2\cos^2\alpha}{g} \quad ...(6)$$

Solving equation (5) & (6), we get,

$R^2 - 4hR\cot\alpha - 4h^2 = 0$

$$\Rightarrow R = \frac{4h\cot\alpha \pm \sqrt{16h^2\cot^2\alpha + 16h^2}}{2}$$

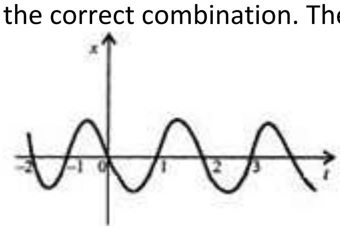
Taking only +ve value, we get,

$R = 2h\cot\alpha + 2h\,\mathrm{cosec}\,\alpha$

$$= 2h\left(\frac{\cos\alpha}{\sin\alpha} + \frac{1}{\sin\alpha}\right) = 2h\frac{(1+\cos\alpha)}{\sin\alpha}$$

$R = 2h\cot\alpha/2$

Q4. Figure gives the x-t plot of a particle executing one dimensional simple harmonic motion. Mark the correct combination. The signs of position, velocity and acceleration variables at



(A) t = 0.3 s, x < 0, u < 0, a < 0
(B) t= 1.2 s, x > 0, u > 0, a > 0
(C) t= -1.2 s, x > 0, u > 0, a < 0
(D) t= -0.3 s, x > 0, u < 0, a < 0

Sol. (D)

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Between -0.5 < t < 0.5, the graph has a negative slope.

$\Rightarrow \frac{dv}{dt} < 0$ or $v < 0$

At t = -0.3s, the slope becomes more and more

negative, so $\frac{dv}{dt} < 0$ or $a < 0$.

$x > 0$ is visible.

Negative, so $\frac{dv}{dt} < 0$ or $a < 0$

$x > 0$ is visible.

Q5. Two bodies of masses m1 and m2 are connected by alight, inextensible string which passes over a frictionless pulley. If the pulley is moving upward with uniform acceleration g, then the tension in the string is

(A) $\frac{4m_1 m_2}{m_1 + m_2} g$

(B) $\frac{m_1 + m_2}{4m_1 m_2} g$

(C) $\frac{m_1 m_2}{m_1 + m_2} g$

(D) $\frac{m_1 - m_2}{m_1 + m_2} g$

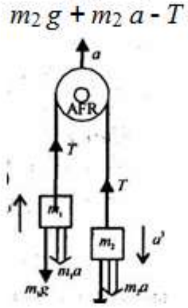
Sol. (A)

If pulley is accelerated upwards with a, then it becomes an AFR.

Let a' be the acceleration for m_1 and m_2 in AFR, then,

$T - m_1 g - m_1 a = m_1 a'$ ...(1)

$m_2 g + m_2 a - T = m_2 a'$ ...(2)



Do (1) , (2),

$$\frac{T - m_1 (g + a)}{m_2 (g + a) - T} = \frac{m_1}{m_2}$$

$Þ\ m_2 T - m_1 m_2 (g + a)$

$= m_1 m_2 (g + a) - m_1 T$

$Or\ (m_1 + m_2) T = 2 m_1 m_2 (g + a)$

$$T = \frac{2 m_1 m_2 (g + a)}{m_1 + m_2}$$

$$Here\ \ a = g\ Þ\ T = \frac{4 m_1 m_2\, g}{m_1 m_2}$$

Q6.

A house is built on the top of a hill with 45° slope. Due to sliding of material and sand from top to bottom of hill the slope

angle has been reduced. If the coefficient of static friction between sand particles is 0.75, what is the final angle attained by the hill?

$\tan^{-1}(0.75)$ 37°

(A) 8°
(B) 45°
(C) 37°
(D) 30°

Sol. (c)

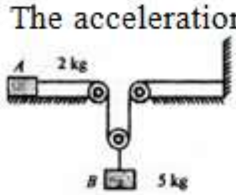
As sand particles are sliding down, the slope of the hill gets reduced. The sand particles stop coming down when component of the gravity force along the hill is balanced by limiting friction force.

$mg \sin q = m$, $mg \cos q\ Þ\ q = \tan^{-1}(m_s) =$

37^0 Where q is the new slope angle of hill.

Q7.

The accelerations of the blocks A and B shown in the figure are



(A) $\frac{5g}{13}, \frac{5g}{13}$

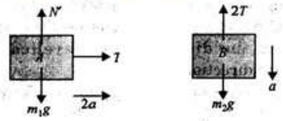
(B) $\frac{10g}{13}, \frac{5g}{13}$

(C) $\frac{10g}{13}, \frac{10g}{13}$

(D) $\frac{5g}{7}, \frac{10g}{7}$

Sol. (B)

First we split the bodies 'into two systems and then draw free body diagrams. Considering A and B as two different system According to geometry of arrangement, distance travelled by A in horizontal direction will be double to the distance travelled by B in downward direction. Thus if the acceleration of B is a and that of A is 2a.



Applying Newton's 2nd law of motion to A and B, we have,

$T = m_1 (2a)$ ..(1)

$m_2 g - 2T = m_2 a$ ...(2)

Solving for a, we get,

$$a = \frac{m_2 g}{m_2 + 4m_1} = \frac{5xg}{5+g} = \frac{5g}{13}$$

\ Acceleration of $A = 2a = \frac{10g}{13}$

Acceleration of $B = a = \frac{5g}{13}$

Q8. A block of mass M is hanging over a smooth and light pulley through a light string. The other end of the string is pulled by a constant force F. The kinetic energy of the block increases by 20 J in 1 s. Identify the correct statement?

(A) The tension in the string is Mg

(B) The tension in the string is F

(C) The work done by the tension on the block is 20 J in the above 1

Sol. (B)

Q9. The question contains statement-I (Assertion) and Statement-2 (Reason). The question has four choices. You have to select the correct choice. Assertion: Wire through which current flows gets heated. Reason: When current is drawn from a cell, chemical energy is converted into electrical energy.

(A) if statement-1 is true but statement-2 is false if

(B) 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

Sol. (D)

Q10.

Study the following

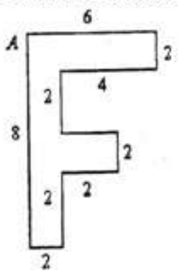
a. position of centre of mass of a triangle	e. at one-fourth of maximum height from the base
b. Position of centre of mass of a sphere	f. at the point of inter-section of medians
c. Position of centre of mass of a cone	g. at the point of inter-section of diagonals
d. Position of centre of mass of square	h. at the centre

(A) a → f; b → h; c → e; d → g
(B) a → g; b → h; c → e; d → f
(C) a → g; b → h; c → f; d → e
(D) a → g; b → f; c → e; d → h

Sol. (A)

Q11.

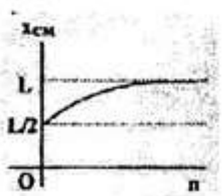
Find the centre of mass of the letter F which cut from a uniform metal sheet from point A



(A) 15/7, 33/7
(B) 15/7, 23/7
(C) 22/7, 33/7
(D) 33/7, 22/7

Sol. (B)

Q12. A thin rod of length L is lying along the x - axis with its ends at x= 0 and x= L. Its linear density (mass/leng th) varies with x as K(X/l)^n ,where n can be zero or any positive numberIf the position XCM of the centre of mass of the rod is plotted against n, which of the following graphs best approximat es the dependece of X_{cm} on n ?

(A) 

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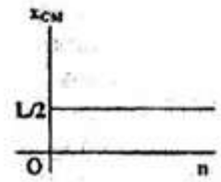
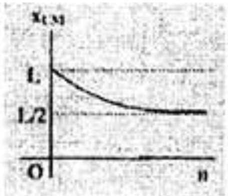
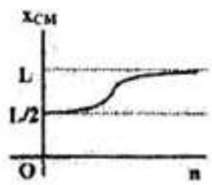
(B) 

(C) 

(D) 

Sol. (A)

Q13. Six identical particles each of mass "m" are arranged at the corners of a regular hexagon of side length "L". If the masses of any two adjacent particles are doubled, the shift in the centre of mass is
(A) L / 8
(B) $\sqrt{3}$L / 8
(C) 3L/16
(D) 3L/4

Sol. (B)

Q14. A planet has $2^{1/3}$ times the radius of the earth. The escape velocity of a body on the planet will be (mass of planet is equal to that of earth.)
(A) same as earth
(B) higher than earth
(C) lower than earth
(D) cannot be determined

Sol. (C)

Q15. The question contains statement-1 (Assertion) and Statement-2 (Reason). It has four choices. You have to select the correct choice. Assertion: Space rockets are usually launched in the equatorial line from west to east. Reason: The acceleration due to gravity is minimum at the equator.

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(A) if statement-1 is true but statement 2 is false. if
(B) 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. (D)
We know that earth revolves from west to east about its polar axis. Therefore all the particles on the earth have velocity from west to east. This velocity is maximum in the equatorial line, as u = Rew, where Re is the radius of earth and w is the angular velocity of Revolution of earth about its polar axis. When a rocke1 is launched from west to east in equatorial plane, the maximum linear velocity is added to the launching velocity of the rocket, due to which launching becomes easier.

Q16. A body has to be placed in an orbit of height H from the surface of the earth. The body should be projected with a velocity of

(A) $\sqrt{\frac{GM}{R+H}}$
(B) $\sqrt{\frac{GM}{H}}$
(C) greater than $\sqrt{\frac{GM}{R+H}}$
(D) lesser than $\sqrt{\frac{GM}{R+H}}$

Sol. (C)

Q17. A wire elongates by {mm when a load W is hanged from it. If the wire goes over a pulley and two weights W each are hung at the two ends, the elongation of the wire will be (in mm)
(A) 2ℓ
(B) zero
(C) ℓ/2
(D) ℓ

Sol. (D)

Q18. Ice and water have the same chemical composition. But ice floats on water because
(A) their densities are equal
(B) density of ice is more than that of water
(C) the volume of a given mass of ice is greater than the volume of the same mass of water
(D) ice is less hot

Sol. (C)

Q19. A steel and a copper wire have the same length but the diameter of the steel wire is twice that of copper wire. The ratio of Young's modulus for steel to that of copper wire is 2 : 1. If they are stretched by the same force, their elongations will be in the ratio of
(A) 2 : 1
(B) 4 : 1
(C) 1 : 8
(D) 8 : 1

Sol. (C)

Q20. A Carnot's engine takes 300 cal of heat at 500 K and rejects 150 cal of heat to the sink. The temperature of the sink is
(A) 1000 K
(B) 750 K
(C) 250 K
(D) 125 K

Sol. (C)

Q21. The kinetic energy of translation of the molecules in 1 mole of ammonia at 27 ºC is nearly
(A) 3740 J
(B) 2830 J
(C) 8.310 J
(D) 21466 J

Sol. (A)

$$\text{Translational K.E.} = \text{Translational degree of freedom} \times \frac{1}{2}\text{KT} \times \text{N} = \frac{3}{2} \times RT = 3740\ J.$$

Q22. 1 g of steam is sent into 1 g of ice. The resultant temperature of the mixture is
(A) 50º C
(B) 60º C
(C) 230º C
(D) 270º C

Sol. (B)

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Q23. If the temperature of patient is 40ºC, his temperature on the Farenheit scale will be
(A) 104º F
(B) 72º F
(C) 96º F
(D) 100º F

Sol. (A)

Q24. Assertion (A): Two rods of the same material have the same lengths but diameters are in the ration of 1:2. If 1000 cal of heat are supplied to the two rods separately the ratio of their linear expansion is 8:1. Reasion (R): The linear expansion e = láÄt
(A) A and R are correct and R is correct explanation for A
(B) A and R are correct and R is not correct explanation
(C) for A A is true and R is false
(D) A is wrong and R is true

Sol. (A)

Q25. The relation between the coefficient of real expansion (ãr) and coefficient of apparent expantion (ãa) of a liquid and the coefficient linear expansion (ág) of the material of the container is
(A) $\gamma_r = \alpha_g + \gamma_\alpha$
(B) $\gamma r = \alpha_g + 3\gamma_\alpha$
(C) $\gamma_r = 3\alpha_g + \gamma_\alpha$
(D) $\gamma_r = 3(\alpha_g + \gamma_\alpha)$

Sol. (C)
$g_r = g_a + g_g$

Q26. What intensity is 3 dB louder than a sound intensity 20μW / cm^2 ?
(A) 20 μW/cm^2
(B) 80 ìW/cm^2
(C) 10 μ/cm^2
(D) 40 μW/cm^2

Sol. (D)

Q27. When an aeroplane attains a speed higher than the velocity of sound in air, a loud bang is heard. This is because
(A) it produces a shock wave which is received as the bang
(B) it explodes
(C) its wings vibrate so violently that the bang is heard
(D) the normal engine noises undergo doppler shift generating the bang

Sol. (A)

Q28. Consider 10 identical sources of sound all giving the same frequency but having random phase angles. If average intensity of each source is Iï, the average of resultant intensity I due to all these 10 sources is

(A) $I = 2.25\, I_i$

(B) $I = I_i$

(C) $I = 100\, I_i$

(D) $I = 10\, I_i$

Sol. (D)

Q29. Velocity of sound waves in air is 330 m/s. For a particular sound in air, a path difference of 40 cm is equivalent to a phase difference of 1.6ð. The frequency of this wave is

(A) 330 Hz

(B) 660 Hz

(C) 165 Hz

(D) 150 Hz

Sol. (B)

$$40 \rightarrow 1.6\pi$$

$$\lambda \rightarrow 2\pi$$

$$\therefore \lambda = \frac{2\pi \times 40}{1.6\pi} = 50cm = 0.5m \quad \therefore v = f\lambda \qquad f = \frac{330}{0.50} = 660Hz$$

Q30. On a winter day, sound travels with velocity 336m/s. If velocity at 0ºC is 332 m/s, the atmospheric temperature is

(A) 7ºC

(B) 10ºC

(C) -7ºC

(D) 8º

Sol. (A)

$$v_t = 332 + 0.6\theta \Rightarrow 336 = 332 + 0.6\theta \Rightarrow \theta = \frac{40}{6} = 6.6 \approx 7^o\ C.$$