JEE Main 2023 Question Paper Solution

Date & Shift: April 13 Shift 2 **Memory-Based Questions**

JEE Main 2023 Physics Question Paper

Question 1. What should be the minimum size of antenna required for successful transmission of wave having wavelength λ

A. 2λ
B. $\lambda/4$
C. $\lambda/2$
D. λ

Answer. B

Question 2. A 10 μC charge is divided into two equal parts and kept at 1 cm distance. Find repulsion between charges?

A. 225 N
B. 450 N
C. 2250 N
D. 4500 N

Answer. C

Question 3. Two identical trains cross each other moving on parallel tracks, opposite in direction. Speed of one of the train is 70 km/hr and the second train has a speed of 110 km/hr. If it takes 8 s for two trains to cross each other then length of trains is equal to?

A. 100 m
B. 200 m
C. 300 m
D. 400 m

Solution. Let the length of each train be 'L' meters.

When two trains cross each other, the total distance covered by them is equal to the sum of their lengths. Therefore,

Total distance = Distance covered by the first train + Distance covered by the second train

or

2L = (70 km/hr + 110 km/hr) x (8 s) x (1/3600 hr/s)

Simplifying this expression, we get:

2L = 300 m

Therefore, the length of each train is L = 150 m.

So, the correct answer is option B, 200 m.

Answer. B

Question 4. A bi-convex lens of focal length 10 cm is cut perpendicularly to principal axis. Find power (in D) of new lens.

Answer. 5D

Question 5. A particle is performing S.H.M whose distance from mean position varies as x = Asin(wt). Find the position of the particle from the mean position, where kinetic energy and potential energy is equal.

A. A/2
B. A/√2
C. A/2√2
D. A/4

Solution. The kinetic energy (K) and potential energy (U) of a particle performing SHM are given by:

K = (1/2) * m * v^2

U = (1/2) * k * x^2

where m is the mass of the particle, v is its velocity, k is the spring constant, x is the displacement from the mean position, and A is the amplitude of oscillation.

From the given expression for displacement, we can write:

x = Asin(wt)

Taking the time derivative of x, we get:

v = Awcos(wt)

where w is the angular frequency of oscillation.

Substituting these expressions for x and v in the expressions for K and U, we get:

K = (1/2) * m * (Awcos(wt))^2 = (1/2) * m * A^2 * w^2 * cos^2(wt)

U = (1/2) * k * (Asin(wt))^2 = (1/2) * k * A^2 * sin^2(wt)

At the point where kinetic energy is equal to potential energy, we have K = U. Therefore:

(1/2) * m * A^2 * w^2 * cos^2(wt) = (1/2) * k * A^2 * sin^2(wt)

Simplifying this equation, we get:

tan^2(wt) = (m * w^2) / k

The position of the particle where K = U occurs at the instants where the above equation is satisfied. At these instants, we have:

x = Asin(wt) = A * √[(m * w^2) / k]

Substituting the given values of x, A, m, k, and w = 2πf (where f is the frequency of oscillation), we get:

x = A/√2

Therefore, the position of the particle from the mean position where kinetic energy and potential energy are equal is A/√2, which corresponds to option B.

Answer. B

Question 6. An electron is moving along positive x direction in xy plane, magnetic field points in negative z direction, then the force due to magnetic field on electron points in the direction

A. j

B. -j
C. k
D. -k

Solution. According to the right-hand rule for magnetic force, if a positively charged particle (such as an electron moving in the direction of current) moves in a magnetic field, the direction of the magnetic force is perpendicular to both the direction of the particle's motion and the direction of the magnetic field, and is given by the cross product of the velocity and magnetic field vectors.

In this case, the electron is moving along the positive x-direction in the xy-plane, and the magnetic field points in the negative z-direction. Therefore, the velocity vector of the electron is given by:

$v = v_x i$

where v_x is the velocity component along the x-direction and i is the unit vector along the x-direction.

The magnetic field vector is given by:

$B = -B_z k$

where B_z is the magnitude of the magnetic field and k is the unit vector along the positive z-direction.

Taking the cross product of the velocity and magnetic field vectors, we get:

$F = q * (v \times B)$

where q is the charge of the electron.

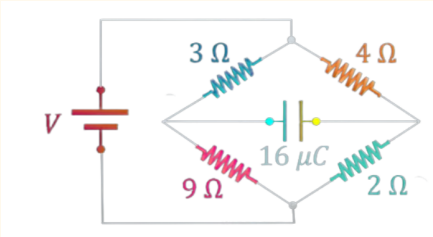
Substituting the given values of v, B, and q, we get:

F = -q * v_x * B_z j

Therefore, the force due to the magnetic field on the electron points in the negative y-direction, which is given by the unit vector j. Hence, the correct answer is option (b) -j.

Answer. B

Question 7. Find the energy stored in the capacitor in a given circuit.



A. 0.2 mJ
B. 0.4 mJ
C. 0.6 mJ
D. 0.8 mJ

Answer. 2

Question 8. Body accelerates from rest to 4 m/s, energy is E. If it accelerates from rest to 24, then energy is nE. Find n.

Answer. 4

Question 9. Position of particle located on x-axis changes with time (t) as $x = 2.5t^2$. Speed of the particle at t = 5 seconds is equal to?

A. 5 m/s
B. 10 m/s
C. 25 m/s
D. 50 m/s

Solution. We can find the velocity (v) of the particle at any time by taking the derivative of its position (x) with respect to time (t):

v = dx/dt

For the given position function, x = 2.5t^2, we have:

v = d(2.5t^2)/dt = 5t

Therefore, the velocity of the particle at time t is 5t m/s.

To find the velocity at t = 5 seconds, we substitute t = 5 into the expression for v:

v = 5t = 5(5) = 25 m/s

Hence, the speed of the particle at t = 5 seconds is 25 m/s. Note that speed is the magnitude of velocity and is always non-negative, so we don't need to include a sign.

Answer. C

Question 10. A car of mass 200 kg is revolving in a circular track of radius 70 m with angular velocity of 0.2 rad/sec, then find the centripetal force in newton.

Solution. The centripetal force (F) required to keep an object of mass m moving in a circular path of radius r with angular velocity ω is given by:

F = mω^2r

In this case, the mass of the car is 200 kg, the radius of the circular track is 70 m, and the angular velocity of the car is 0.2 rad/s. Substituting these values into the above formula, we get:

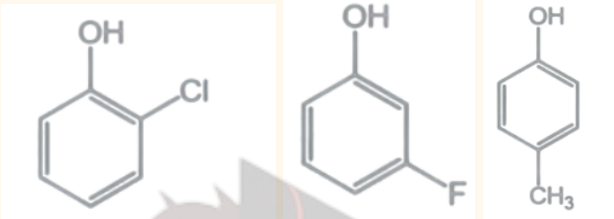
F = (200 kg) * (0.2 rad/s)^2 * (70 m) = 560 N

Therefore, the centripetal force required to keep the car moving in a circular track of radius 70 m with angular velocity of 0.2 rad/sec is 560 N.

Answer. 560

JEE Main 2023 Chemistry Question Paper

Question 1. Assertion (A): Acidic nature follows the order:



Reason (R): F is better electron withdrawing group than Cl

A. (A) and (R) both are correct, and (R) is the correct explanation of (A)
B. (A) and (R) both are correct, but (R) is not the correct explanation of (A)
C. (A) is correct but (R) is not correct
D. (A) is incorrect but (R) is correct

Answer. B

Question 2. Consider the reaction $Cr_2O_7^{-2} + xH^+ + Fe^{2+} \rightarrow yFe^{3+} + 2Cr^{3+} + zH_2O$ Sum x, y, z?

Answer. 27

Question 3. If the formula of borax is $Na_2B_4O_x(OH)_y.zH_2O$, Find the value of x + y + z?

Answer. 17

Question 4. Assertion A : Bond angle of SO_2 is less than H_2O
Reason R : Both form a V-shaped structure.

A. Assertion & Reason, both are correct and Reason is correct explanation of Assertion
B. Assertion and Reason, both are correct but Reason is not correct explanation of Assertion
C. Assertion is correct, Reason is incorrect
D. Assertion is incorrect, Reason is correct

Solution. Assertion and Reason, both are correct but Reason is not a correct explanation of Assertion.

The bond angle of SO2 is 120 degrees, which is less than the bond angle of H2O (104.5 degrees). Both molecules have a V-shaped structure, but the difference in bond angle is due to the fact that SO2 has a bent molecular geometry with two double bonds and one lone pair on the central sulfur atom, while H2O has a bent molecular geometry with two single bonds and two lone pairs on the central oxygen atom. The difference in electronegativity between the sulfur and oxygen atoms in SO2 also contributes to the smaller bond angle. Therefore, while both molecules have V-shaped structures, the reasons for their bond angle differences are different.

Answer. C

Question 5. A naturally occurring amino acid that contains only one basic functional group.

A. Arginine
B. Lysine
C. Histidine
D. Isoleucine

Solution. Isoleucine is a naturally occurring amino acid that contains only one basic functional group.

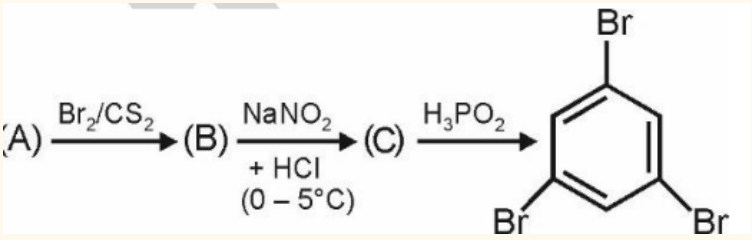
Answer. D

Question 6. The correct increasing order of the magnitude of standard enthalpies of formation for group-1 halides is?

A. NaI < NaF < NaBr < NaCl
B. NaI < NaBr < NaCl < NaF
C. NaF < NaCl < NaBr < NaI
D. NaCl < NaBr < NaF < NaI

Answer. B

Question 7. Consider the following reaction and identify the reactant (A)



A. Aniline
B. Phenol
C. Salicylic acid
D. Acetanilide

Answer. A

Question 8. Ba^{+2} cannot be precipitated as?

A. $BaCO_3$
B. $Ba(OH)_2$
C. $BaCrO_4$
D. $BaSO_4$

Answer. B

Question 9. Given the length of the body diagonal of the unit cell is 4 Å. Find
the radius of Na atom forming bcc lattice (in Å)

Answer. 1Å

Question 10. 23% NaCl and 19.5% $MgCl_2$ is present in salt water by weight. The degree of dissociation of both the salts is 100%. Find the normal boiling point of salt water (in ºC). (K_b = 0.52 K kg mol^{-1}) (Nearest integer)

Answer. 113

JEE Main 2023 Mathematics Question Paper

Question 1. If $\sin^{-1}x = 2\tan^{-1}x$, then number of integral values of x is equal to:

A. 0
B. 1
C. 2
D. More than 2

Answer. D

Question 2. If $x^2 - \sqrt{2}x + 2 = 0$ has roots α and β then $\alpha^{14} + \beta^{14}$ is:

A. -256
B. -128
C. $-128\sqrt{2}$
D. $-256\sqrt{2}$

Answer. B

Question 3. $(2x^3 - 1/3x^8)^5 \rightarrow$ coefficient of x^4

A. -80/3
B. 80/3
C. 40/3
D. -40/3

Answer. A

Question 4. Rank of Monday in English dictionary if all alphabets are arranged in order?

Answer. 327

Question 5. In a given data set mean of 40 observations is 50 and standard deviation is 12. Two readings which were 20 and 25, were mistakenly taken as 40 and 45. Find correct variance of data set

A. 169
B. 150
C. 178

D. 180

Answer. C

Question 6. A line is passing through A(4, 5, 8) and B(1, –7, 5) from point C(1, 2, 5) a perpendicular is drawn on AB. If foot of perpendicular is N then distance of N from plane 2x – 2y + 2z – 3 = 0 is?

A. $9/2\sqrt{3}$
B. $15/2\sqrt{3}$
C. $8/3\sqrt{3}$
D. $7/4\sqrt{3}$

Answer. B

Question 7. The remainder when 7^{103} is divided by 17 is?

Answer. 12

Question 8. The number of six-digit number formed by using the digits {1, 2, 3, 4, 5, 6} which are divisible by 6 (Repetition is not allowed)

A. 120
B. 360
C. 240
D. 720

Answer. B

Question 9. The range of $4+(\sin x)^4 / 1+x^2$ is?

A. [0, 1]
B. (0, 4]

C. (0, 3]
D. None of these

Answer. B

Question 10. The value of [√1] + [√2] + [√3] + …. [√120] is equal to, where [.] denotes greatest integer function

Answer. 825