JEE Main 2024 Question Paper Feb 1 Shift 2 (B.E./B.Tech)

JEE Main Physics Questions

Ques 1. Two trains run on North-South parallel tracks. Train A moves with velocity 20 m/s towards North and train B moves with velocity 30 m/s towards South. Then find the velocity of train B with respect to train A.

Ans. 50 m/s

Ques 2. A body of mass of 4 kg experiences two forces \( \vec{F}_1 = 5\hat{i} + 8\hat{j} + 7\hat{k} \), \( \vec{F}_2 = 3\hat{i} - 4\hat{j} - 3\hat{k} \) then acceleration acting on the body R

Ans. \( \sqrt{6} \)

Ques 3. A source produced electromagnetic wave of frequency 60 MHz. Find the wavelength of this wave in air.

Ans. 5 m

Ques 4. In the figure shown, find the ratio of tensions in the strings, \( T_1/T_2 \)

A. \( \frac{1}{4} \)
B. ½
C. ⅓
D. 4

Ans. D

Ques 5. A Big drop is formed by coalescing 1000 small droplets of water. The surface water. The surface energy will become.

Ans. 1/10.

Ques 6. A solid sphere is rolling purely with speed v on horizontal surface. It rolls up an incline surface and stops at height h. Then height h is [g is the acceleration due to gravity]:
   A. 3 v^2/10 g
   B. 7 v^2/10 g
   C. 5v^2/7 g
   D. 7v^2/5 g

Ans. B

Ques 7. If the power of a light source is P and frequency of photons emitted is f. Find number photons emitted in time t.
   A. Pt/2hf
   B. Pt/hf
   C. 1pf/2 ht
   D. Pf/ht

Ans. B

Ques 8. There are two cubical Gaussian surface carrying charges as shown. Find ratio of fluxes through surface C₁ and C₂:
A. 1:1
B. 2:5
C. 5:2
D. 2:3

Ans. B

Ques 9. Find the number of significant digits in the value 10.05 :

Ans. 4

Ques 10. A ball of mass 120 g moving with initial velocity 25 m/s is stopped by an external force F in 0.15 sec. Find value of F in newton :

Ans. 20

Ques 11. Find the ratio of the charge on 4 µF to that on 2 µF in steady state.

Ans. 3

Ques 12. If the rms velocity of hydrogen gas molecules is Vo, find the rms velocity of oxygen molecules at same temperature :
A. $V_o$
B. $V_o/2$
C. $V_o/4$
D. $V_o/3$

Ans. C

Ques 13. In the meter bridge shown below, the null point is at 40 cm from A. If R is shunted by 22, find the distance of new balance point from A

A. 22.7 cm  
B. 60 cm  
C. 62.5 cm  
D. 60.5 cm

Ans. C

Ques 14. A particle is moving in circular path of radius $r$ speed $v$ such that speed is proportional to radius as $V \propto r^{3/2}$. Then how does time period of revolution depends on $r$ i.e $T \propto r^n$ then $n$ is.

A. $-\frac{1}{2}$  
B. $\frac{5}{2}$  
C. $-\frac{5}{2}$  
D. $\frac{1}{2}$

Ans. B

Ques 15. In the given circuit, find electric current drawn from battery:

In the given circuit, find electric current drawn from battery:
Ques 1. Number of radial nodes present in 3p are
   A. 0
   B. 1
   C. 2
   D. 4

   Ans. B

Ques 2. Which of the following compounds have colour due to d-d transition?
A. KMnO₄
B. K₂Cr₂O₇
C. K₂CrO₄
D. CuSO₄.5H₂O

Ans. D

Ques 3. Which of the following compounds has intramolecular hydrogen bonding in it?
   A. NH₃
   B. H₂O
   C. [Chemical structure image]
   D. [Chemical structure image]

Ans. B

Ques 4. Which of the following has the highest 3rd ionization energy?
   A. Mn
   B. V
   C. Cr
   D. Fe

Ans. A

Ques 5. A 10 mL hydrocarbon (CₓHₙ) on combustion give 40 mL CO₂ and 50 mL H₂O. Calculate the value of x+y

Ans. 14
Ques 6. Solubility of $\text{Ca}_3(\text{PO}_4)_2$ in 100 mL of pure water is $W$ gm. Find out $K_{sp}$ of $\text{Ca}_3(\text{PO}_4)_2$ is:
(M: Molecular mass of $\text{Ca}_3(\text{PO}_4)_2$)

A. $108 \times (W/M)^5$
B. $108 \times 10^5 \times [W/M]^5$
C. $108 \times 10^4 \times [W/M]^5$
D. $108 \times 10^6 \times [W/M]^5$

Ans. B

Ques 7. Which of the following sets of elements can be detected by Lassaigne's Test?
A. N and S only
B. N, P and S only
C. P and halogens only
D. N, P, S and halogens

Ans. D

Ques 8. Which of the following compounds in 3d series does not show +3 oxidation state?
A. V
B. Cr
C. Mn
D. Cu

Ans. D

Ques 9. What is the order of reducing character for $\text{AsH}_3$, $\text{NH}_3$, $\text{PH}_3$ (group 15 hydrides)?
A. $\text{NH}_3 > \text{PH}_3 > \text{AsH}_3$
B. PH3 > NH3 > AsH3  
C. AsH3 > PH3 > NH3  
D. NH3 > AsH3 > PH3

Ans. C

Ques 10. Which of the following compounds has the highest boiling point?  
A. Butanol  
B. Diethylether  
C. Butane  
D. Butanol

Ans. A

Ques 11. Consider the following two statements
Statement I: $\pi$ 2p bonding molecular orbital has low electron density above & below internuclear axis  
Statement II: $\pi^*$2p antibonding molecular orbital has only one nodal plane
A. Both Statement I and Statement II are correct  
B. Both Statement I and Statement II are incorrect  
C. Statement I is incorrect, but Statement II is correct  
D. Statement I is correct, but Statement II is incorrect

Ans. B

Ques 12. Consider the following two statements
Statement I: SiO$_2$ and GeO$_2$ are acidic, SnO and PbO are amphoteric  
Statement II: Allotropes of carbon are formed due to catenation and $d\pi - \rho\pi$ bond
A. Both Statement I and Statement II are correct  
B. Both Statement I and Statement II are incorrect  
C. Statement I is correct, but Statement II is incorrect  
D. Statement I is incorrect, but Statement II is correct
Ques 13. Consider the following two statements
Statement I: In p and d block both metals and non - metals are present
Statement II: Electronegativity and ionisation enthalpy of metals is greater
than non - metals
A. Both Statement I and Statement II are correct
B. Both Statement I and Statement II are incorrect
C. Statement I is correct, but Statement II is incorrect
D. Statement I is incorrect, but Statement II is correct

Ans. B

Ques 14. Ethylene glycol of x kg is mixed with 18.6 kg of solvent, 24 °C
depression in freezing point takes place.
Calculate value of x.
(Given: \(K_1 = 1.6 \, ^\circ\text{C/molal}\) M.W. of ethylene glycol = 62 g/mol)

Ans. 17

Ques 15. Find out charge (in C) required for electrolysis of 1 mole of H₂O
to produce O₂ on one of the electrodes. (F = 96500 C)

Ans. 193000
Ques 1. Let $\alpha$ and $\beta$ the roots of equation $px^2 + qx - r = 0$, where $P \neq 0$. If $p, q, r$ be the consecutive term of non constant G.P and $1/\alpha + 1/\beta = 3/4$ then the value of $(\alpha - \beta)^2$ is:

Ans. $80/9$

Ques 2. If the mirror image of the point $P(3,4,9)$ in the Line

\[
\frac{x-1}{3} = \frac{y+1}{2} = \frac{z-2}{1}
\]

is $(\alpha, \beta, \gamma)$ then find $14(a+\beta+y)$ is:

Ans. $108$

Ques 3. The number of solution of the equation

\[
4\sin^2 x - 4\cos^3 x + 9 - 4\cos x = 0, \quad x \in [-2\pi, 2\pi]
\]

is:

Ans. $0$

Ques 4. If the domain of the function

\[
f(x) = \frac{\sqrt{x^2-25}}{(\sqrt{4-x^2})} + \log(x^2 + 2x - 15)
\]

is $(-\infty, \alpha) \cup (\beta, \infty)$, then

$\alpha^2 + \beta^2$ is equal to $b$

Ans. $50$

Ques 5. Let the system of equations $x + 2y + 3z = 5$, $2x + 3y + z = 9$, $4x + 3y + \lambda z = \mu$ have an infinite number of solutions. Then $\lambda + 2\mu$ is equal to
Ques 6. The value of \( \int_{0}^{1} (2x^3 - 3x^2 - x + 1)^{1/3} \, dx \) is:
   A. -1
   B. 1
   C. 0
   D. 2

Ans. 0

Ques 7. The probability that Ajay will not go to office is \( \frac{1}{5} \) and probability that Ajay and Vijay will not go to the office is \( \frac{2}{7} \), if their visits to office is independent of each other, then find the probability that Ajay will go to the office, but Vijay will not go, is
   A. 12/28
   B. 13/35
   C. 18/35
   D. 24/35

Ans. C

Ques 8. \( \int_{0}^{\pi/3} \cos^4 x \, dx \) is equal to \( a\pi + b\sqrt{3} \), then \( a^2 + b \) is equal to:
   A. \( \frac{1}{2} \)
   B. \( \frac{1}{6} \)
   C. \( \frac{1}{4} \)
   D. 1

Ans. B

Ques 9. Let \( m \) and \( n \) be the coefficient of 7th and 13th term in expansion of \( (1/3x^{1/3} + 1/2x^{2/5})^{18} \), then \( (m/n)^{1/3} \) is:
   A. \( \frac{1}{4} \)
   B. 4/7
Ques 10. The minimum value of \( |z| \leq 1 \) is,
A. 3/2
B. 5/2
C. 3
D. 5

Ans. A

Ques 11. Let vertex A(2, 3, 1), B(3, 2, -1), C(-2, 1, 3). If AD is angle bisector of angle A, then projection of \( \vec{AD} \) on \( \vec{AC} \) is equal to:
A. \( \sqrt{3}/2 \)
B. \( \sqrt{3/2} \)
C. \( \sqrt{3}/2 \)
D. 2/\sqrt{3}

Ans. B

Ques 12. \( \frac{dy}{dx} = \frac{(1-x-y^2)/y} \) and \( x(1)=1 \), then 5x(2) is equal to____.

Ans. 5

Ques 13. There are 20 lines numbered as 1,2,3,..., 20. And the odd numbered lines intersect at a point and all the even numbered lines are parallel. Find the maximum number of point of intersections

Ans. 101
Ques 14. Let $a_1, a_2, a_3, \ldots, a_n$ be in A. P. and $S_n$ denotes the sum of first $n$ terms of this A. P. is $S_{10} = 390$, $a_{10}/a_{50} = 15/7$, then $S_{15} - S_5 = \underline{\phantom{000}}$.

Ans. 365