

JEE Main 2024 Question Paper April 8 Shift 1 (B.E./B.Tech)

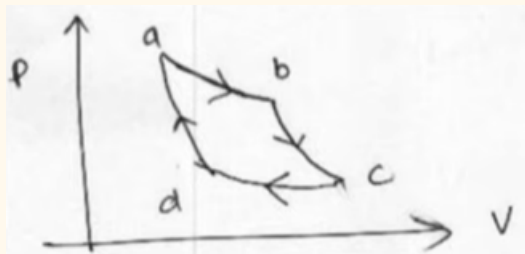
JEE Main Physics Questions

Ques 1. The correct expression for Bernoulli's theorem is (the symbols have their usual meaning)

- A. $P + \rho gh + \rho v^2 = \text{constant}$
- B. $P + \frac{1}{2} \rho gh + \frac{1}{2} \rho v^2 = \text{constant}$
- C. $P + \rho gh + \rho v^2 = \text{constant}$
- D. $P + 2\rho gh + \rho v^2 = \text{constant}$

Ans. A

Ques 2. The PV curve shown in the diagram consists of two isothermal and two adiabatic curves. Then:



- A. $V_a / V_d = V_b / V_c$
- B. $V_a / V_d = (V_b / V_c)^{-1}$
- C. $V_a / V_d = (V_b / V_c)^2$

D. $V_a / V_d = V_c / V_b$

Ans. A

Ques 3. In a series LCR Circuit, the value of resistance as well as ($X_L - X_C$) is halved, then the new current amplitude (I_2) will satisfy: (I_1 is old current amplitude)

- A. $I_2 = 2I_1$
- B. $I_2 = 0$
- C. $I_2 = I_1 / 2$
- D. $I_2 = I_1$

Ans. A

Ques 4. In a clock, second hand and minute hand are of 75 cm and 60 cm respectively. After 30 minutes, ratio of distance travelled by the tip of second hand to that of minute hand is x. Find x.

Ans. 75

Ques 5. If the resultant of the vectors shown in $A\sqrt{x}$, find x.



Ans. 3

Ques 6. A ball initially at rest, breaks into two masses m_1 and m_2 that move with speed v_1 and v_2 respectively as shown. The ratio of the kinetic energy of the right mass to the left mass is:

- A. m_1/m_2**
- B. m_2/m_1**
- C. m_1^2/m_2^2**
- D. m_2^2/m_1^2**

Ans. B

Ques 7. Critical angle for a pair of medium is given to be 45° . Find the ratio of the refractive index of rarer to denser medium.

- A. $1 : \sqrt{3}$**
- B. $1 : \sqrt{2}$**
- C. $1 : 2$**
- D. $2 : 1$**

Ans. B

Ques 8. A ball of mass 150 gm moving with speed 20m/s is caught in 0.1 sec. find the average force exerted by the hands.

- A. 40 N**
- B. 60 N**
- C. 20 N**
- D. 30 N**

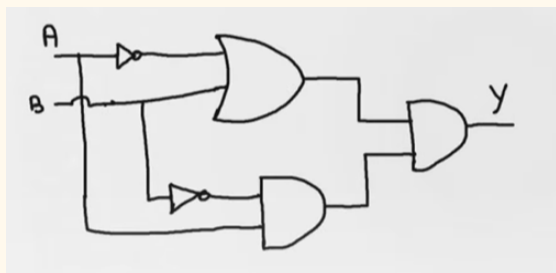
Ans. D

Ques 9. In an electron and a proton are having the same kinetic energy, find the ratio of their linear momentum. (mass of electron = 9.1×10^{-31} kg, mass of proton = 1.67×10^{-27} kg)

- A. 1.67×10^{-3} kg-m/s
- B. 1.33×10^{-2} kg-m/s
- C. 1.23×10^{-2} kg-m/s
- D. 2.33×10^{-2} kg-m/s

Ans. D

Ques 10. For the given logic circuit, the correct relation between the input (A, B) and the output (Y) is



- A. $Y = 0$
- B. $Y = A \cdot \bar{B}$
- C. $Y = A + \bar{B}$
- D. $Y = \bar{A} \cdot B$

Ans. A

Ques 11. The organ pipe having same length, one is open while the other is closed. Find ratio of 7th overtone of those organ pipes.

- A. 15/16
- B. 16/15
- C. 14/15

D. 13/14

Ans. B

Ques 12. Two planets of mass m_1 and m_2 are revolving around their orbits r and r_2 respectively. Angular momentum of planets are in ratio of 3 then T_1/T_2 is ____

(T_1 and T_2 are periods of revolutions)

A. $27 (m_2/m_1)^3$

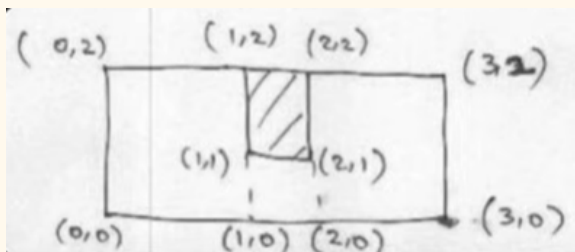
B. $1/27 (m_2/m_1)^3$

C. $(r_1/r_2)^3$

D. $(r_2/r_1)^{3/2}$

Ans. A

Ques 13. From a rectangular sheet, the shaded portion is removed. Find the co-ordinates of center of mass after the portion has been removed.



A. (1.5, 0.9)

B. (2.5, 1.5)

C. (1,1)

D. (2,2)

Ans. A

Ques 14. Which of the following is incorrect for paramagnetic materials?

- A. They are strongly attracted by magnetic field**
- B. Magnetic susceptibility is slightly more than zero.**
- C. They align in the direction of magnetic field**
- D. None of the above**

Ans. A

Ques 15. If radius of earth reduced by one fourth of its present value, then duration of days will be

- A. 13 hours and 30 mins**
- B. 13 hours and 20 mins**
- C. 18 hours and 20 mins**
- D. 16 hours and 10 mins**

Ans. A

Ques 16. An electromagnetic radiation of intensity 360 W/cm^2 is incident normally on a non-reflecting surface having area A. Average force on the surface is found to be $2.4 \times 10^{-4} \text{ N}$. Find the value of A.

- A. 0.02 m^2**
- B. 0.2 m^2**
- C. 2 m^2**
- D. 20 m^2**

Ans. A

Ques 17. A solenoid of 10 turns cross section area 36 cm^2 and of resistance $10 \text{ m}\Omega$ is placed in a magnetic field which is varying at a constant rate of 0.5 T/sec . Find power of heat dissipation.

- A. 1.8 W**
- B. 3.8 W**
- C. 3.24 W**
- D. 7.6W**

Ans. C

Ques 18. The diameter of a sphere having mass 8.635 gm is measured by a vernier scale. 10 divisions of vernier scale coincide with 9 divisions of main scale and main scale division is 1 mm . If the reading of the main scale is 2 cm & 2nd division of vernier coincide with a main scale division, the density of the sphere is

- A. 2.2 g/cm^3**
- B. 2 g/cm^3**
- C. 2.5 g/cm^3**
- D. 1.75 g/cm^3**

Ans. B

Ques 19. Three particles having different masses have the same momentum. Find the ratio of their kinetic energy. ($m_1 = 400 \text{ gm}$, $m_2 = 1.2 \text{ kg}$, $m_3 = 1.6 \text{ kg}$)

- A. 1:2:3**
- B. 3:2:1**
- C. 2.5: 0.8: 0.6**
- D. 2.8: 0.6: 0.8**

Ans. C

Ques 20. In a diffraction pattern of a monochromatic light of wavelength 6000 pm, the slit width is 3 mm. If the angular position of 2nd minima is $N \times 10^{-6}$ rad, find N.

Ans. 4

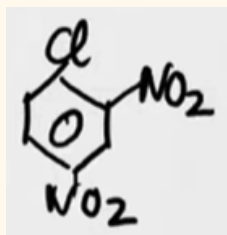
Ques 21. The ratio of molar heat capacity at constant volume of one mole monoatomic gas to the one mole diatomic gas is given as a/b , where a and b are co-prime number, then find (a + b)

Ans. 8

JEE Main Chemistry Questions

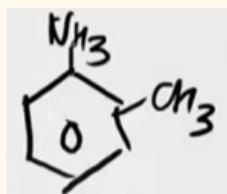
Ques 1. Consider following statements.

S1:



IUPAC name is 4-chloro-1,3-dinitrobenzene

S2:



IUPAC name is 2-methylaniline

- A. Both S-1 and S-2 are correct**
- B. S-1 is correct, S-2 is incorrect**

- C. S-1 is incorrect, S-2 is correct
- D. Both S-1 and S-2 are incorrect

Ans. C

Ques 2. We have two complexes, $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$, the magnetic properties respectively are

- A. Diamagnetic and diamagnetic
- B. Paramagnetic and Paramagnetic
- C. Diamagnetic and Paramagnetic
- D. Paramagnetic and Diamagnetic

Ans. B

Ques 3. Find among the spin only magnetic moment (nearest integer) of M in MO_4^{2-} , M being the atom having least atomic radii among Sc, Ti, V, Cr, Mn, Zn.

Ans. 0

Ques 4. A solution contains 100 g water and 10 g of AB_2 , The boiling of the solution was found to be 100.52% The degree of dissociation of AB_2 is:

[MW of AB = 200 gm/mol ; $K_b = 0.52 \text{ Kkg/mol}$]

Ans. 0.5

Ques 5.

S-I: Stability of +1 oxidation state increases as $\text{Ga} < \text{In} < \text{Tl}$.

S-II: Stability of +1 oxidation state increases down the group due to inert pair effect.

- A. Both S-1 and S-2 are correct**
- B. Both S-1 and S-2 are incorrect**
- C. S-1 is correct and S-2 is incorrect**
- D. S-1 is incorrect and S-2 is correct**

Ans. A

Ques 6. $\text{CoCl}_3 \cdot x\text{NH}_3$ on reaction with excess $\text{AgNO}_3(\text{aq.})$ gives two moles of AgCl as precipitate.

Summation of oxidation state of Co in $\text{CoCl}_3 \cdot x\text{NH}_3$ and x is:

- A. 7**
- B. 8**
- C. 9**
- D. 10**

Ans. B

Ques 7.

$X \rightleftharpoons Y; K_1 = 1$

$Y \rightleftharpoons Z; K_2 = 2$

$Z \rightleftharpoons W; K_3 = 4$

Find K_{eq} for $X \rightleftharpoons W$

- A. 12**
- B. 8**
- C. 2**
- D. 4**

Ans. B

Ques 8. Which of the following compounds will not give Hinsberg's test

- A. $\text{NH}_2\text{-NH-CO -NH}_2$**
- B. $\text{CH}_3\text{CO-NH}_2$**
- C. $\text{CH}_3\text{-CH}_2\text{-NH}_2$**
- D. $\text{CH}_3\text{-NH-CH}_3$**

Ans. B

Ques 9. Find the mass (in g) of O_2 required for the combustion of 900 g of glucose.

Ans. 960

Ques 10. Find out the magnitude of work done on the gas when 1 mole of an ideal gas undergoes compression from 9 litre to 1 litre through a reversible isothermal process. (in Joule) (Nearest integer)

Ans. 4981

JEE Main Mathematics Questions

Ques 1. For $8^{2x} - 16 \cdot 8^x + 48 = 0$, the sum of values of x is equal to:

- A. $1 + \log_6 8$
- B. $1 + \log_8 6$
- C. $\log_8 6$
- D. 16

Ans. B

Ques 2. If

$$I(x) = \int \frac{6dx}{\sin^2 x (1 + \cot x)^2}$$

and $I(0)$ then $I(\pi/2)$ is equal to

- A. $(21 - 9\sqrt{3}) / (3 - \sqrt{3})$
- B. $(21 + 9\sqrt{3}) / (3 - \sqrt{3})$
- C. $21 / (3 - \sqrt{3})$
- D. $(3 + \sqrt{3}) / (3 - \sqrt{3})$

Ans. A

Ques 3. Let $f(x) = \cos x - x + 1$, $x \in [0, \pi]$, then

- A. $f(x)$ is increasing in $(0, \pi)$
- B. $f(x)$ is decreasing in $(0, \pi)$
- C. $f(x)$ is increasing in $(0, \pi/2)$ and decreasing in $(\pi/2, \pi)$
- D. $f(x)$ is decreasing in $(0, \pi/2)$ and increasing in $(\pi/2, \pi)$

Ans. B

Ques 4. A =

$$\begin{bmatrix} 2 & -1 \\ 1 & 1 \end{bmatrix},$$

if sum of diagonal elements of A^{13} is 3^n then n equal to:

- A. 5
- B. 7
- C. 9
- D. 13

Ans. B

Ques 5. 3 blue balls and 4 yellow balls are in a box. 3 balls are drawn at random. Let variance and mean be X & Y respectively then value of $3X + 4Y$ is:

- A. 5.21
- B. 8.39
- C. 7.34
- D. 6.54

Ans. C

Ques 6. If $C_1: (x-\alpha)^2 + (y-\beta)^2 = r_1^2$, $C_2: (x-6)^2 + (y - 15/2)^2 = r_2^2$ touches each other at (6, 6). If line joining centres of C_1 & C_2 is divided by (6, 6) in 2: 1 internally, then $(\alpha + \beta) + 4(r_1^2 + r_2^2)$ is equal to:

- A. 54

- B. 36
- C. 18
- D. 17

Ans. A

Ques 7. $R = (a, b) : a + 5b = 42$ and $a, b \in \mathbb{N}$ has m elements and

$\sum_{n=1}^m (1 + i^{n!}) = x + iy$ (where $i = \sqrt{-1}$). Find $x + y + m$.

- A. 20
- B. 12
- C. 8
- D. 13

Ans. A

Ques 8.

$$\text{If } y = \int \frac{e^{\tan x} dx}{\cos^2 x (1 + e^{2 \tan x})}$$

and $y(0) = 6$ then $y(\pi/4)$ is equal to

- A. $\tan^{-1} e - \pi/4$
- B. $\tan^{-1} e + 6 - \pi/4$
- C. $\tan^{-1} e - 6 + \pi/4$
- D. $\tan^{-1} 1/e - 6 + \pi/4$

Ans. B

Ques 9. The area bounded by $y = \min\{\sin x, \cos x\}$ and x-axis in $-\pi \leq x \leq \pi$ interval is equal to (in sq. units):

- A. 4
- B. 8
- C. $2 - 2\sqrt{2}$
- D. $5 - 2\sqrt{2}$

Ans. A

Ques 10. Let,

$$f(\theta) = \frac{\sin^4 \theta + 3 \cos^2 \theta}{\sin^4 \theta + \cos^2 \theta},$$

then range of $f(\theta) \in [a, b]$. The sum of infinite G.P., where first term is 64 and common ratio is a/b is equal to:

- A. 32
- B. 64
- C. 96
- D. 108

Ans. C

Ques 11.

	1			
	2	3		
	4	5	6	
7	8	9	10	

If this pattern continues then in which row number, the number 5437 lies.

- A. 103
- B. 104
- C. 102
- D. 105

Ans. B

Ques 12. Find the number of 3 - digit numbers which are not divisible by 3 and made using the digits {2, 3, 5, 7,4} and repetition is not allowed.

Ans. 36

Ques 13. Let $f(x) = (2x - 3)^{2/3}(x + 2)$. The number of critical points of $f(x)$ is equal to

Ans. 2

Ques 14. If

$A = \begin{bmatrix} 2 & a & 1 \\ 1 & 3 & 1 \\ 0 & 5 & b \end{bmatrix}$ and $A^3 = 4A^2 - A - 21I$, then $(2a + 3b)$ is equal to:

- A. 33**
- B. -23**
- C. -13**
- D. 7**

Ans. C

Ques 15. If sum of two positive numbers a & b is 24 then the probability of product of numbers is not less than $\frac{3}{4}$ times of the maximum possible product of a & b, then probability of such event is $\frac{m}{n}$ (m, n are co-prime) then n - m is

- A. 1**
- B. 3**
- C. 5**
- D. 7**

Ans. A

Ques 16. Let $\sin x = -\frac{3}{5}$; $\pi < x < \frac{3\pi}{2}$ then $80(\tan^2 x - \cos x)$ is equal to:

- A. 109**
- B. 108**
- C. 9**
- D. 8**

Ans. A

Ques 17. If $|z + 2| = 1$, $\text{Im}(z+1/z+2) = 1/5$ then $\text{Re}(z) < -2$ is equal to:

A. 24/25

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

C. 12/5

D. $\frac{3}{5}$

Ans. A