

JEE 2024 FEB 1st Shift-1 Questions

HISTORY CREATED

39 YEARS OF ACADEMIC EXCELLENCE

ASIS'S GREATEST EDUCATION BRAND IN

IIT-JEE, NEET & OLYMPIADS

THE PERFECT HAT-TRICK WITH ALL-INDIA RANK 1

JEE MAIN



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01-Feb-2024 Shift-1

Maths

1. Number of ways of arranging 5 officers in 4 rooms

Ans: (1024)

2. If 3, a, b, c are in A.P. and 3, a - 1, b + 1 are in G.P., then Arithmetic mean of a, b and c is:

- (a) 11
- (b) 10
- (c) 9
- (d) 13

Ans: (a)

3. If 3, 7, 11,, 403 = A.P.₁ and 2, 5, 8,, 401 = A.P.₂ Find the sum of common terms of A.P.₁ and A.P.₂

- a) 3366
- b) 6699
- c) 9999
- d) 6666

Ans: (b)

4. $\int_{-\pi/2}^{\pi/2} \frac{8\sqrt{2}\cos x dx}{(1+e^{\sin x})(1+\sin^4 x)} dx = a\pi + b \log(3 + 2\sqrt{2})$, where a + b

- a) 4
- b) 6
- c) 8
- d) 2

Ans: (a)

5. The value of integral $\int_0^{\pi/4} \frac{x dx}{\cos^4 2x + \sin^4 2x} =$

Ans: $(\frac{\pi^2}{16\sqrt{2}})$

6. $L_1: \vec{r} = (i + 2j + 3k) + \lambda(i - j + k)$; $L_2: \vec{r} = (4i + 5j + 6k) - \mu(i + j - k)$

Intersect L_1 and L_2 at P and Q respectively. If (α, β, γ) is the midpoint of the line segment PQ, then $2(\alpha + \beta + \gamma)$ is equal to

7. $y = y(x)$ solution of equation $\frac{dy}{dx} = 2x(x+y)^3 - x(x+y) - 1$,

$$y(0) = 1 \left(\frac{1}{\sqrt{2}} + y \left(\frac{1}{\sqrt{2}} \right) \right)^2 = ?$$

(a) $\log \frac{4}{4+\sqrt{e}}$

(b) $\frac{2}{1+\sqrt{6}}$

(c) $\frac{3}{3-\sqrt{e}}$

(d) $\frac{1}{2-\sqrt{e}}$

Ans: (d)

8. The area enclosed by the curves $xy + 4y = 16$ and $x + y = 6$ is equal to

(a) $30 - 32 \log_e^2$

(b) $32 - 30 \log_e 2$

(c) $30 - 28 \log_e^2$

(d) $28 - 30 \log$

Ans: (b)

9. If the system of equations $2x + 3y - z = 5$; $x + \alpha y + 3z = -4$;
 $3x - y + \beta z = 7$ have many solutions, then $13 \alpha \beta$ is equal to

(a) 1110

(b) 1120

(c) 1210

(d) 1220

Ans: (b)

10. A bag contains 8 balls, whose colours are either white or black back. 4 balls are drawn at random without replacement and it was found that 2 balls are white and other 2 balls are black. The probability that the bag contains equal number of white and black balls is :

a) $\frac{1}{5}$

b) $\frac{1}{7}$

c) $\frac{2}{5}$

d) $\frac{2}{7}$

Ans: (d)

11. Given: $5f(x) + 4f\left(\frac{1}{x}\right) = x^2 - 4$ & $y = 9f(x) \cdot x^2$. If y is strictly increasing, then find interval of x .

- (a) $\left(-\infty, -\frac{1}{\sqrt{5}}\right] \cup \left(\frac{1}{\sqrt{5}}, 0\right)$
- (b) $\left(-\frac{1}{\sqrt{5}}, 0\right) \cup \left(0, \frac{1}{\sqrt{5}}\right)$
- (c) $\left(0, \frac{1}{\sqrt{5}}\right) \cup \left(\frac{1}{\sqrt{5}}, \infty\right)$
- (d) $\left(-\sqrt{\frac{2}{5}}, 0\right) \cup \left(\sqrt{\frac{2}{5}}, \infty\right)$

Ans: (d)

12. It n is the number of ways five different Employees can sit into four indistinguishable offices where any offices equal may have any number of persons including zero, then

- a) 47
- b) 51
- c) 43
- d) 53

Ans: (b)

13. Let $S = \{x \in \mathbb{R} : (\sqrt{3} + \sqrt{2})^x + (\sqrt{3} - \sqrt{2})^x = 10\}$. number of Elements in s is:

- a) 2
- b) 0
- c) 1
- d) 4

Ans: (a)

14. If the hyperbola $x^2 - y^2 \operatorname{cosec}^2 \theta = 5$ and ellipse $x^2 \operatorname{cosec}^2 \theta + y^2 = 5$ has eccentricity e_H and e_E respectively and $e_H = \sqrt{7}e_E$, then θ is equal to

- (a) $\frac{\pi}{3}$
- (b) $\frac{\pi}{6}$
- (c) $\frac{\pi}{2}$
- (d) $\frac{\pi}{4}$

Ans: (a)

15. $\vec{a} = -5\vec{i} + \vec{j} - 3\vec{k}$, $\vec{b} = \vec{i} + 2\vec{j} - 4\vec{k}$, $\vec{c} = [(\vec{a} \times \vec{b}) \times \vec{j}] \times \vec{j}$ then $\vec{c} \cdot (-\vec{i} + \vec{j} + \vec{k})$

Ans: (-12)

16. If $(t + 1)dx = (2x + (t + 1)^3)dt$ and $x(0) = 2$, then $x(1)$ is equal to:

- a) 5
- b) 12
- c) 6
- d) 8

Ans: (b)

17. $\frac{x-\lambda}{-2} = \frac{y-2}{1} = \frac{z-1}{1}$ and $\frac{x-\sqrt{3}}{1} = \frac{y-1}{-2} = \frac{z-2}{1}$, if the Shortest distance between the above two lines is 1 then sum of possible values of λ

- (a) 0
- (b) $2\sqrt{3}$
- (c) $3\sqrt{3}$
- (4) $-2\sqrt{3}$.

Ans: (b)

18. If $A = \begin{bmatrix} \sqrt{2} & 1 \\ -1 & \sqrt{2} \end{bmatrix}$, $B = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$, $C = ABA^T$ and $x = A^T C^2 A$,

then $|x|$ is equal to.

- a) 729
- b) 891
- c) 27
- d) 243

Ans: (a)

19. Five people are distributed in four identical rooms. A room can also contain zero people. Find the number of ways to distribute them.

- (a) 47
- (b) 53
- (c) 43
- (d) 51

Ans: (d)

20. Let $S = \{1, 2, 3, \dots, 20\}$, $R_1 = \{(a, b) : a \text{ divide } b\}$,

$R_2 = \{(a, b) : a \text{ is integral multiple of } b\}$ and $a, b \in S$. $n(R_1 - R_2) = ?$

Ans: (46)

1-Feb-2024 Shift-1

Chemistry

1. In case of isoelectronic species the size of F^- , Na and Na^+ is affected by:
- Principle Quantum number (n)
 - Electron – electron interaction
 - Nuclear charge (z)
 - None of the factors because their size is the same

Ans: c

2. In Kjeldahl's method for estimation of nitrogen, $CuSO_4$ acts as
- Oxidising agent
 - Reducing agent
 - Catalytic agent
 - Hydrolysis agent

Ans: c

3. Find out total possible optical isomers of 2-chlorobutane.

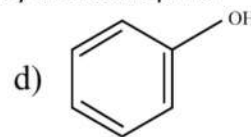
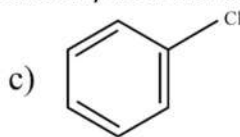
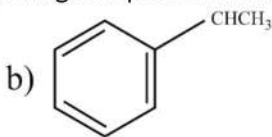
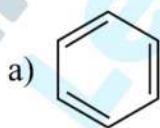
Ans: 2

4. Which of the following complex is homoleptic



Ans: d

5. Which of the following compound will most easily be attacked by an electrophile?



Ans: d

6. If one strand of a DNA has the sequence ATGCTTCA, sequence of the base in complementary stand is

- (a) ATGCGACT
- (b) TACGAAGT
- (c) CATTAGCT
- (d) GTACTIONTAC

Ans: b

7. Which of the following is correct for adiabatic free expansion against vacuum?

- (a) $q = 0, \Delta U = 0, w = 0$
- (b) $q \neq 0, w = 0, \Delta U = 0$
- (c) $q = 0, \Delta U \neq 0, w = 0$
- (d) $q = 0, \Delta U \neq 0, w \neq 0$

Ans: c

8. The total number of deactivating groups among the following is:

$-\text{CN}, -\text{NH}-\text{CO}-\text{CH}_3, -\text{CO}-\text{CH}_3, -\text{NH}-\text{CH}_3$

Ans: 2

9. We are given with following cell reaction: $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$

$P = 2 \text{ atm}$

H_2

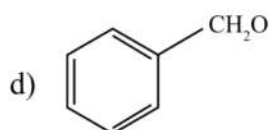
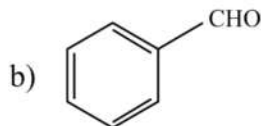
$[\text{H}^+] = 1\text{M}$

$(2.303RT/F = 0.06)$

If E_{cell} of the reaction is given by $-x \times 10^{-3} \text{ V}$. Find out x.

Ans: 9

10. Easily attracted by electrophile



Ans: a

11. Match the following and select the correct option.

List I	List II
(a) $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$	(i) $t_2g^2eg^0$
(b) $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$	(ii) $t_2g^3eg^0$
(c) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$	(iii) $t_2g^3eg^2$
(d) $[\text{V}(\text{H}_2\text{O})_6]^{3+}$	(iv) $t_2g^6eg^2$

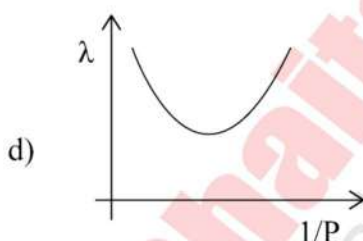
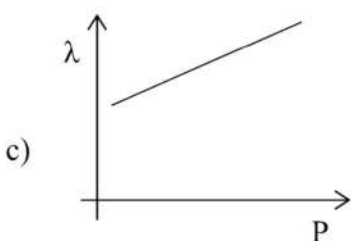
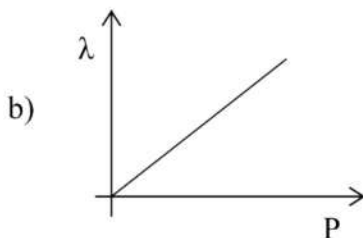
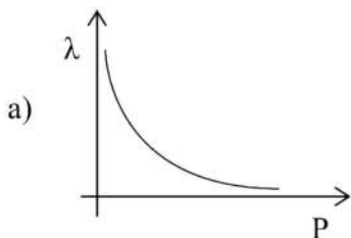
- (a) a - ii, b - iii, c - iv, d - i
 (b) a - iii, b - iv, c - i, d - ii
 (c) a - iv, b - ii, c - iii, d - i
 (d) a - ii, b - iv, c - i, d - iii

Ans: a

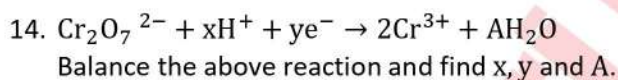
12. Statement I: PH_3 will have lower boiling point than NH_3 .
 Statement II: There are strong van der Waals forces in NH_3 and strong
- (a) Both Statement I and Statement II are correct
 (b) Both Statement I and Statement II are incorrect
 (c) Statement I is correct, but statement II is incorrect
 (d) Statement I is incorrect, but Statement II is correct

Ans: c

13. Which of the following is the correct plot between λ (de-Broglie wavelength) and p (momentum)?



Ans: a



- (a) $x = 7, y = 6, A = 14$
 (b) $x = 14, y = 6, A = 7$
 (c) $x = 14, y = 3, A = 7$
 (d) $x = 8, y = 2, A = 1$

Ans: b

15. We are given with 3NaCl samples and their Van 't Hoff factors

Sample	van 't Hoff factor
Sample -1(0.1M)	i_1
Sample -2(0.01M)	i_2
Sample -3(0.001M)	i_3

- (a) $i_1 = i_2 = i_3$
 (b) $i_1 > i_2 > i_3$
 (c) $i_3 > i_2 > i_1$
 (d) $i_1 > i_3 > i_2$

Ans: a

16. Potential for the given half cell at 298 K is $(-)___\times 10^{-2}V$
 $2H^+ + 2e^- \rightarrow H_2(g)$ $[H^+] = 1M, P_{H_2} = 2atm$ $\frac{2.303 RT}{F} = 0.06V;$
Ans: 0.9×10^{-2}

17. How many of the following are trigonal bipyramidal structure
 $BF_3, PCl_5, BrF_5, [Fe(CO)_5], PF_5$
Ans: 5

18. What is the pH of $CH_3COO^-NH_4^+$? (At 25 °C)
 Given: K_a of $CH_3COOH = 1.8 \times 10^{-5}$, K_b of $NH_4OH = 1.8 \times 10^{-5}$
 (a) 7
 (b) 9
 (c) 8.9
 (d) 7.8
Ans: a

01-Feb-2024 Shift-1

Physics

1. Determine Energy released when an electron jumps to ground state in Balmer series

Ans: $E=1.9 \text{ eV}$

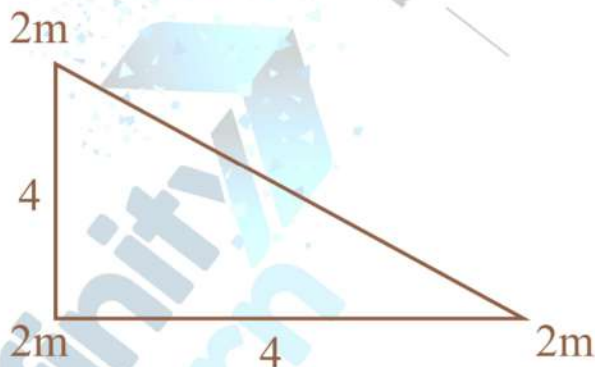
2. Determine ratio of debroglie wavelength of α - particle and proton

Ans: $1:2$

3. What is length of the pendulum at a height equal to twice radius of earth given small g equals to Π^2

Ans: $l=1/9m$

4. Find the centre of mass of the following system



Ans: $x=3$

5. If ratio of de-Broglie wavelength of proton and alpha particle is same then find the ratio of their speeds.

Ans: 4

6. Find percentage change in capacitance if potential difference across it has been changed from V to $2V$.

Ans: $\Delta C=0$

7. By rising temperature what happens to young's modular?

- A) Decreases
- B) remains same
- c) Increases
- d) none of these

Ans: a

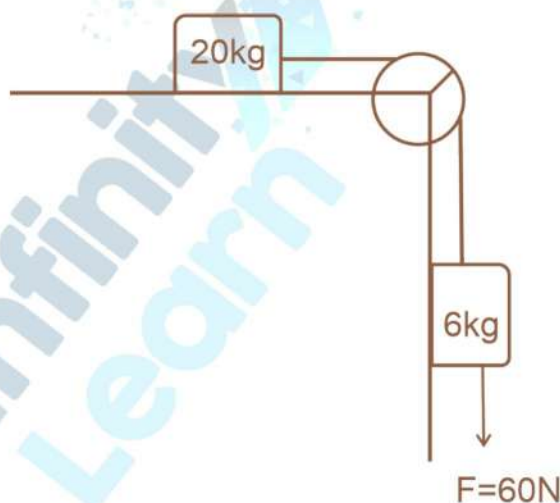
8. Two moles of monoatomic gas and 6 moles of diatomic gas are mixed find C_v of the mixture.

Ans: $=9/4 R$

9. Dimensional formula of Angular impulse

Ans: $= (ML^2T^{-1})$

10. Find acceleration of the system if an external force of $60 N$ is applied on $6 kg$ block as shown.



Ans: $=80\text{N}$.

11. wavelength of photon and α -particle is λ and 2λ then ratio of their velocities

Ans: $1/8$

12. Radius of a nucleus is 4.8 fermi and mass number is 64 . Find atomic mass of nucleus of radius 4 fermi.

Ans: $x=27$

13. Statement 1: Value of young's modulus increases on increasing temperature.

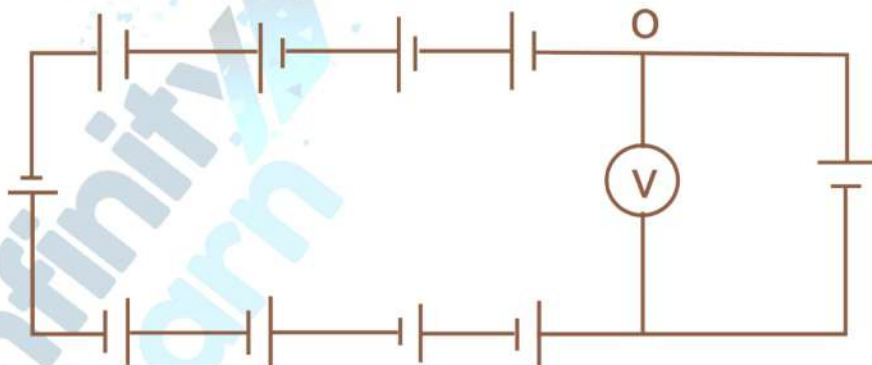
Statement 2: Value of young's modulus decreases on increasing temperature.

Ans: $y=F/(A<\Delta)\uparrow$

14. An electron jumps from 3rd excited state in Balmer series of Hydrogen spectrum. Find the amount of energy released.

Ans: 2.55ev

15. All batteries are identical (5 V, 0.2Ω) and connected as shown in the figure find the reading of voltmeter



Ans: $r=0$

16. Dimension of angular momentum is same as:

Ans: $=ML^2 T^{-1}$

17. A bullet of mass 10^{-2} kg moving with speed 2×10^2 m/s hits a ballistic pendulum of length 1 m and mass 1 kg horizontally and gets embedded in it. Find the maximum height till which it rises.

Ans: $h=0.2\text{m}$

18. The length of a seconds pendulum if it is placed at height $2R$ from the surface of the earth (R : radius of earth) is $\frac{10}{x\pi^2}$ m.

Find x .

Ans: 9

19. A bullet of mass 10^{-2} kg and velocity 200 m/s gets embedded inside the bob of mass 1 kg of a simple pendulum. The max. height that the system rises by is cm.

Ans: 20

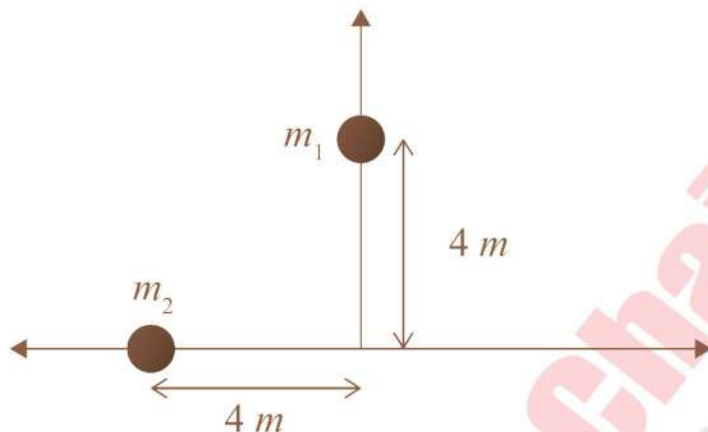
20. Position of a particle moving along x-axis is given by $x = 6t^3 - t^2 - t$, find the speed of the particle when its acceleration becomes zero. Particle starts from $x = 5$ m.

Ans: $= -19/18\text{m/sec}$

21. Two identical charged particles of mass density 1.5 g/cm^3 are connected by individual strings of equal length from a common point and the system is placed in air. If angle between the strings does not change when dipped in water then find the dielectric constant of water.

Ans: 3

22. Two particles each of mass 2 kg are placed as shown in x – y plane. If the distance of centre of mass from origin is $\frac{4\sqrt{2}}{x}$, find x :



Ans: $x=2$

23. Find the magnetic field at the center of current carrying regular hexagon wire of side length a and current i.



Ans: 6×10^{-7} Tesla

24. Value of capacitance is changed from C to 4C in an LC circuit. Find the effect on the value of inductance if resonance frequency remains same.

Ans: $L_2 = \frac{L}{2}$

25. In a polytropic process, $PV^{3/2} = \text{constant}$. Find work done in this process from state (P_1, V_1, T_1) to state (P_2, V_2, T_2) .

Ans: $= \frac{nR\Delta T}{(1-\gamma)}$

26. A particle is performing horizontal circular motion of radius R with constant speed v . Its time period is T . Another particle is projected with same speed at an angle θ such that its maximum height is $2R$. Find the value of θ .

Ans: $\sin \theta = \frac{T}{\sqrt{R}}$

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