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39 Years of Excellence 1986-2024

2024 JEE 31st 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

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31-Jan-2024 Shift-1

Maths

1. If $f(x)=\begin{vmatrix} x^3 & 2x^2+1 & 1+3x \\ 3x^2+2 & 2x & x^3+6 \\ x^3-x & 4 & x^2-2 \end{vmatrix}$, then the value of $2f(0)+f'(0)$ is equal to

   (a) 18
   (b) 54
   (c) 48
   (d) 42

   Ans: (d)

2. If $f(x)=\frac{4x+3}{6x-4}, x\neq\frac{2}{3}$ and $(f\circ f)(x)=g(x)$, where $g: R-\left[\frac{2}{3}\right. \to R \to \left\{\frac{2}{3}\right\}$, then $(g\circ g\circ g)(4)$ is equal to.

   Ans: (4)

3. Sum of the series $\frac{1}{1-3\cdot1^2+1^4}+\frac{2}{1-3\cdot2^2+2^4}+\frac{3}{1-3\cdot3^2+3^4}+\cdots$ upto 10 terms is

   (a) $-\frac{55}{109}$
   (b) $\frac{55}{109}$
   (C) $\frac{45}{109}$
   (d) $-\frac{45}{109}$

   Ans: (a)

4. If the system of linear equation $x-2y+z=-4; 2x+\alpha y+3z=5$ and $3x-y+\beta z=3$ has infinitely many solutions then $12\alpha+13\beta$ is equal

   Ans: ($\alpha=\frac{1}{3}$, $\beta=\frac{54}{7}$)

5. $\lim_{x\to0}\frac{e^{|2\sin x|-2|\sin x|-1}}{x^2}$ is

   (a) Does not exist
   (b) 2
   (c) 1
   (d) -1

   Ans: (b)

6. If one of the diameters of the circle $x^2 + y^2 - 10x + 4y + 13 = 0$ is a chord of another circle and whose centre is the point of intersection of the lines $2x + 3y = 12$ and $3x - 2y = 5$, then the radius of the circle is
   (a) 6
   (b) $3\sqrt{2}$
   (c) $\sqrt{20}$
   (d) 4
   Ans: (a)

7. Let $\vec{a} = 3\hat{i} + \hat{j} - 2\hat{k}, \vec{b} = 4\hat{i} + \hat{j} + 7\hat{k}$ and $\vec{c} = \hat{i} - 3\hat{j} + 4\hat{k}$ be 3 vectors. If a vector $\vec{p}$ satisfies $\vec{p} \times \vec{b} = \vec{c} \times \vec{b}$ and $\vec{p} \cdot \vec{a} = 0$, then $\vec{p} \cdot (\hat{i} - \hat{j} - \hat{k})$ is equal to
   (a) 32
   (b) 23
   (c) 16
   (d) 61
   Ans: (a)

8. An urn contains 15 red, 10 white, 60 orange balls, 15 green balls. 2 balls are taken with replacement. Find the probability 1 ball is red and other ball is white.
   (a) $\frac{2}{27}$
   (b) $\frac{3}{22}$
   (c) $\frac{1}{33}$
   (d) $\frac{1}{29}$
   Ans: (c)

9. The solution of differential equation $y\frac{dx}{dy} = x(\log_e x - \log_e y + 1)$, $x > 0, y > 0$ and passing through $(e, 1)$ is
   (a) $\left|\log_e \left(\frac{y}{x}\right)\right| = y^2$
   (b) $2\left|\log_e \left(\frac{x}{y}\right)\right| = y$
   (c) $\left|\log_e \left(\frac{y}{x}\right)\right| = x$
   (d) $\left|\log_e \left(\frac{x}{y}\right)\right| = y$
   Ans: (d)

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10. If $f(x) = \frac{4x+3}{6x-4}$ and $g(x) = f(f(x))$, then $g(g(g(g(x))))$ is equal to:
    (a) x
    (b) 2x
    (c) $-x$
    (d) $-2x$
    Ans: (a)

11. $A = \{1,2,3,4\}, R = \{(1,2),(2,3),(2,4)\}, R \subseteq S$ and S is an equivalence relation then the minimum number of elements to be added to R is n, then the value of n is?
    Ans: (13)

12. Let a be the sum of all coefficients in the expression of $(1-2x+2x^2)^{2023}(3-4x^2+2x^3)^{2024}$ and $\boldsymbol{b} = \lim_{x\to 0}\left[\int_0^x \frac{x\log(1+C)}{\frac{t^{2+0^2}x+1}{x^2}}dt\right]$ if the equation $(x^2+dx+e)=0$ and $2bx^2+ax+4=0$ have a common root, where $c,d,e \in R$, then $d:c:R$ equals
    Ans: (1 : 1 : 4)

13. The distance of the point $Q(0,2,-2)$ from the line passing through the $p(5,-4,3)$ & $\perp$ to Line $\bar{\gamma} = (-3\bar{\imath}+2\bar{k}) + \lambda(2\bar{\imath}+3\bar{\jmath}+5\bar{k}), \lambda \in R$ and $\bar{\gamma} = (\bar{\imath}-2\bar{\jmath}+\bar{k}) + \mu(-\bar{\imath}+3\bar{\jmath}+2\bar{k})$ is
    Ans: $(\sqrt{74})$

14. For $\alpha,\beta,\gamma \neq 0$, if $\sin^{-1}\alpha + \sin^{-1}\beta + \sin^{-1}\gamma = \pi$ and $(\alpha+\beta+\gamma)(\alpha-\gamma+\beta) = 3\alpha\beta$ then γ equals.
    Ans: $(\alpha=\beta=\gamma=\frac{\sqrt{3}}{2})$

15. Two marbles are drawn in succession of box containing 10 reds. 30 whites, 20 blues and 15 orange marbles. with replacement made after drowning. than the probability The first marble drawn is red, The second marble drawn is white.
    a) $\frac{4}{75}$
    b) $\frac{2}{25}$
    c) $\frac{2}{3}$,
    d) $\frac{4}{25}$

Ans: (a)

16. $\sum_{r=0}^{n} \frac{{}^{n}c_r \, {}^{n}c_r}{r+1} = \alpha, \sum_{r=0}^{n} \frac{{}^{n}c_r \cdot {}^{n+1}c_r}{r+1} = \beta$

If $4\beta = 7\alpha$, then find n.

A) 2

B) 4

C) 6

D) 8

Ans: (C)

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31-Jan-2024 Shift-1

Physics

1. Stopping potential is 8 V if wavelength of incident light is λ and it is 2 V for 3λ. Find threshold wavelength.

   Ans: $\lambda_T = 9\lambda$

2. Two charges Q and 3Q are kept in a line separated by a distance R. Electric field is zero at a distance x from O. Find the value of x.

   Ans: $x = \frac{(\sqrt{3}-1)R}{2}$

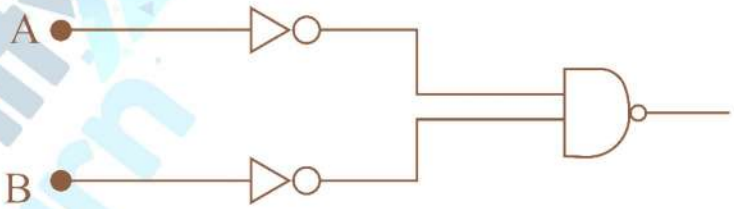
3. If mass defect in a nuclear reaction is 0.4gm then find the Q-value of the reaction.

   Ans: 3.6×10^{13} J

4. Find minimum deviation in a thin prism if refractive index $\mu = \cot\left(\frac{A}{2}\right)$. Here A represents angle of prism.

   Ans: $\delta = \pi - 2A$

5. Output of given circuit represents which logic gate :



   Ans: (OR) Gate

6. Four equal masses m are kept at corners of a square of side a. If net gravitational force on a mass is given by $\left(\frac{2\sqrt{2}+1}{32}\right)\frac{Gm^2}{L^2}$. Find the value of a in terms of L.

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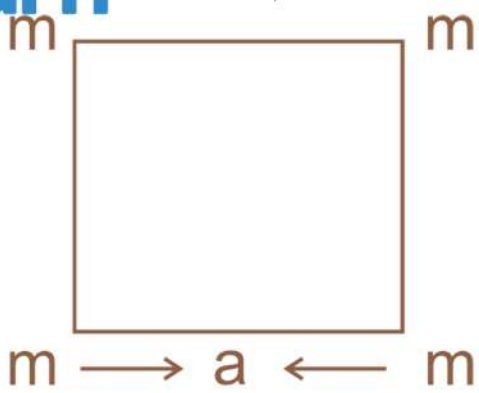
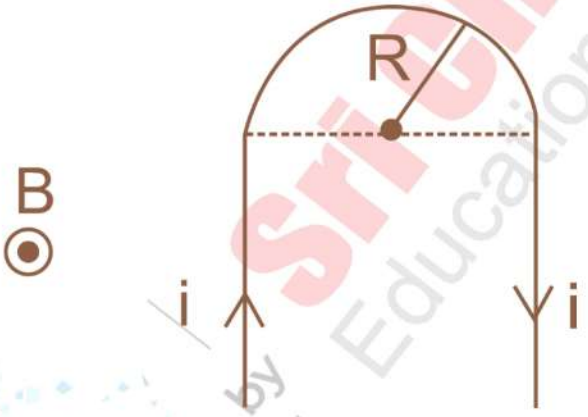


Ans: $Q = 4L$

7. A current carrying wire is placed in an external magnetic field as shown. Find the magnetic force on the given wire.



Ans: 2IRB

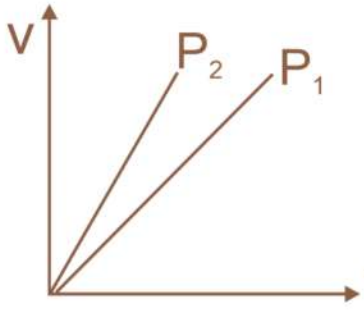
8. If the percentage error in measuring length and diameter of a wire is 0.1% each, then the percentage error of the resistance of the wire is :
   a) 0.3%
   b) 0.2%
   C) 0.1%
   d) 0.4%
   Ans: a
9. An artillery of mass M_1 carries a shell of mass M_2. Initially both are at rest. The artillery fires the shell horizontally on smooth ground. Find the ratio of kinetic energy of artillery and shell.

Ans: $\frac{m_2}{m_1}$

10. For the following equation, force given by $F = ax^2 + bt^{1/2}$. Find the dimension of $\frac{b^2}{a}$.

Ans: $[M'L^3T^{-3}]$

11. For two different isobaric, $V - T$ curves are given. Find the relation between P_1 and P_2.

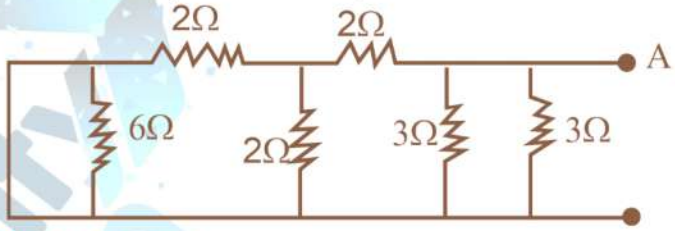


Ans: $P_1 > P_2$

12. A parallel plate capacitor with separation between the plates $5\ mm$, is charged by battery. If the charge on the capacitor is Q-Now if a dielectric slab of thickness $2\ mm$ is filled between the plates, charge increases by 25% then, find dielectric constant of slab.

Ans: k=2

13. Find equivalent resistance across A and B.



Ans: 1Ω

14. The relation between time t and distance x is $t = \alpha x^2 + \beta x$ where α and β are constants. The acceleration is:

Ans: $-2av^3$

15. A block of mass $50\ kg$ is thrown on horizontal ground with a speed of $0.4\ m/s$. Find the work done on the block till it comes to rest.

Ans: $\mu = 0.25$

16. Two rods of same length and area but having thermal conductivity K_1 and K_2 are once connected in series and then in parallel. Find the equivalent thermal conductivity in both the cases.

Ans: $\alpha_r = \frac{\alpha_1+\alpha_2}{2}$

17. The magnetic field is given as $B = B_0\hat{i} + 2B_0\hat{j}$. An electron is moving with a velocity $\vec{v} = 4\hat{i} + 3\hat{j}$. If the force experienced by the electron is $\bar{F} = neB_0\hat{k}$. What is the value of n.

Ans: n=5

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Chemistry

1. Find out the final product C.

$$CH_3 - CH_2 - CH_2 - Br \xrightarrow[KOH]{alc} A \xrightarrow{HBr} B \xrightarrow[KOH]{alc} C$$

a) Propane
b) Propan-1-ol
c) Propan-2-ol
d) propene

Ans: c

2. Which of the following options contain amphoteric oxide(s) only?

a) SnO_2 and SiO
b) SiO_2
c) SnO_2 and PbO_2
d) CO and SiO

Ans: c

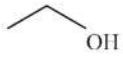
3. How many of the following compounds have sp^3 hybridized central atom?

$F_2O, NH_3, SiO_2, SO_2, CO$ and BF_3

Ans: 4

4. Number of compounds with Sp^3 hybridise H_2O, BF_3, CH_4, CO_2 ... ...

Ans: 3

5. Assertion (A): P*k*a of &  are 10 and 15.9 respectively

Ans: c

6. Which of the following is most acidic?
   (a) 10×2^5
   (b) 10×10^{16}
   (c) 10×10^{-16}
   (d) 5×10^{16}
   Ans: a

7. The compound which is white in colour is
   (a) $ZnSO_4$
   (b) $CuSO_4$
   (c) $FeSO_4$
   (d) $FeCl_3$
   Ans: a

8. On which factor, electrical conductivity of electrolytic cell does not depend
   (a) Concentration of electrolyte
   (b) Amount of electrolyte added
   (c) Temperature
   (d) Nature of electrode
   Ans: d

9. Decreasing order of electron gain enthalpy of the following elements (magnitude only)
   Sulphur - A, Bromine - B, Fluorine - C, Argon - D
   (a) A > B > C > D
   (b) D > C > B > A
   (C) C > B > A > D
   (d) A > B > D > C
   Ans: c

10. Correct IUPAC name of

   (a) 7-Hydroxyheptan-2-one
   (b) 6-Hydroxyheptan-2-one
   (c) 2-Oxoheptan-7-ol
   (d) 1-Hydrogen-6-oxoheptane
   Ans: a

11.

List – I	List – II
(P) Glucose $\xrightarrow[\Delta]{P+HI}$	(1) Sacharic acid
(Q) Glucose $\xrightarrow{NaOHCO_3}$	(2) n-Hexane
(R) Glucose $\xrightarrow{Br_2+H_2O}$	(3) No Reaction
(S) Glucose $\xrightarrow{con\ HNO_3}$	(4) Gluconic acid

(a) $P \rightarrow 2; Q \rightarrow 3; R \rightarrow 4; S \rightarrow 1$
(b) $P \rightarrow 2; Q \rightarrow 3; R \rightarrow 1; S \rightarrow 2$
(c) $P \rightarrow 3; Q \rightarrow 2; R \rightarrow 4; S \rightarrow 1$
(d) $P \rightarrow 1; Q \rightarrow 2; R \rightarrow 3; S \rightarrow 4$

Ans: a

12. Moles of CH_4 required for formation of 22 g of CO_2 is $m \times 10^{-2}$ The value of m is:
Ans: 50

13. The total number of different alkanes formed when the following mixture is subjected to electrolysis:
CH_3COONa (aq) and C_2H_5COONa (aq) is (do not consider disproportionation reaction)
Ans: 3

14. If one faraday of electricity is used in the discharging of Cu^{2+}, then find the mass (in g) of Cu deposited (nearest integer)
Ans: 32

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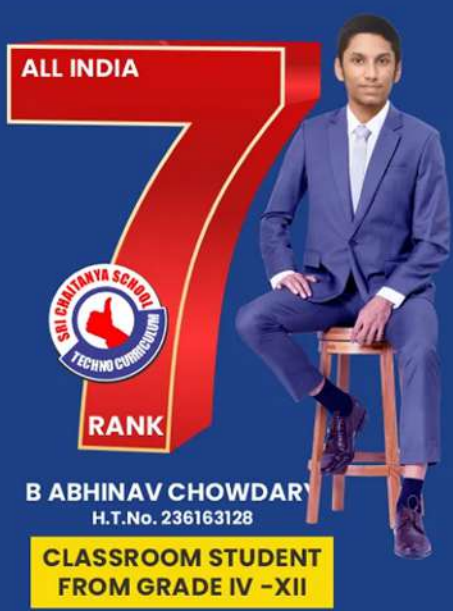

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