JEE Mains 2024 31 January Shift 1 Question Paper

According to the initial views of students who took the JEE Main January 31 Shift 1 exam, the general difficulty of the paper was moderate. Students noted that the Mathematics session was challenging and lengthy. The physics component was said to be easy but challenging. Students rated the chemistry portion as easy. Students also claimed that the Chemistry section contained more NCERT-based questions than the Physics section, which contained mostly formula-based questions.

Candidates can find memory-based questions for each subject on the JEE Mains 2024 31 Jan paper Shift 1 below.

Physics

Q. If two charges Q and 3Q are kept in a line separated by a distance R, the electric field is zero at a distance x from origin O. Find the value of x.

Q. A pulley is placed on top of a triangular surface such that it forms 53° and 37° with the horizontal. The pulley carries two blocks of masses M and m on the 53° incline and 37° incline respectively. If M = 10 kg has an acceleration of 2 m/s2 in the direction of the 53° incline plane, then find the mass m.

Q. If the stopping potential is 8 V for incident light with wavelength λ and it is 2 V for a wavelength of 3λ, then find the threshold wavelength.

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

Q. If the percentage error in measuring the length and diameter of a wire is 0.1% each, then find the percentage error of the resistance of the wire.

Q. What is the logic gate equivalent to the given logic circuit?
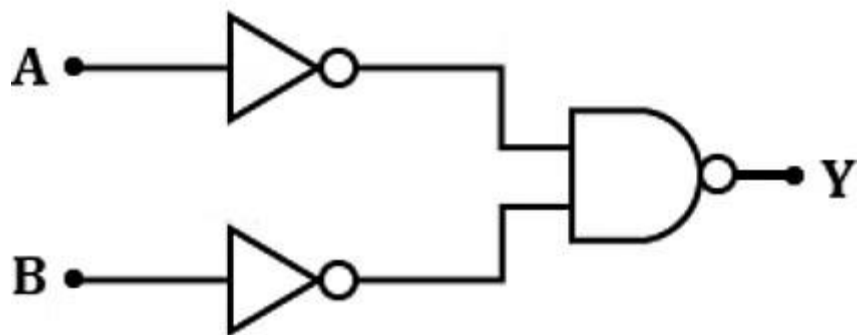
Q. Which of the following compounds is white in colour?
i. ZnSO4
ii. CuSO4
iii. FeSO4
iv. FeCl3

Q. On which of the following factors does the electrical conductivity of an electrolytic cell does not depend?
i. Concentration of electrolyte
ii. Amount of electrolyte added
iii. Temperature
iv. Nature of electrode

Q. A ball dropped from height H rebounds up to height h after colliding with a horizontal surface. If the coefficient of restitution for collision is e = 1/2, then find H/h.

Chemistry

Q. Which of the following options contain amphoteric oxide(s) only?
i. SnO2 and SiO
ii. SiO2
iii. SnO2 and PbO2
iv. CO and SiO

Q. Find out the final product C for the reaction:
CH3–CH2–CH2–Br → (in presence of alcoholic KOH, heat) → Product A
Product A → (in presence of HBr) → Product B
Product B → (in presence of aqueous KOH) → Product C

Q. How many of the following compounds have sp3 hybridized central atom?
H_2O, NH_3 , SiO_2, SO_2 , CO and BF_3

Q. Assertion(A): Noble gases have very high boiling points.
Reason(R): Noble gases have strong dispersion forces. Hence, they liquefy at low temperatures and hence
they have a high boiling point.
i. Both A and R are true and R is the correct explanation of A.
ii. Both A and R are true and R is not the correct explanation of A.
iii. Both A and R are false.
iv. A is true but R is false.

Q. Assertion: The pK value of phenol is 10.0 while that of ethanol is 15.9.
Reason: Ethanol is a stronger acid than phenol.
i. Both A and R are true and R is the correct explanation of A.
ii. Both A and R are true and R is not the correct explanation of A.
iii. Both A and R are false.
iv. A is true but R is false.
Q. The adsorption principle is used in
i. Distillation
ii. Differential Extraction
iii. Chromatography
iv. Vacuum Distillation
Q. How many of the following can be used as electrodes in batteries?
(i) Zinc
(ii) Zinc - Mercury amalgam
(iii) Lead
(iv) Graphite

Mathematics

Q. If the system of linear equation $x - 2y + z = - 4$, $2x + \alpha y + 32 = 5$ & $3x - y + \beta z = 3$ has infinitely many solutions then find the value of $12\alpha + 13\beta$.
Q. ABCD is a parallelogram where $A(\alpha, \beta)$, $B(1,0)$, $C(\gamma, \delta)$, and $D(3,2)$ and $AB = \sqrt{10}$. Find the value of $2(\alpha + \beta + \gamma + \delta)$.
Q. $A = \{ 1, 2, 3, 4 \}$, $R = \{ (1, 2), (2, 3), (2, 4) \}$, $R \subseteq S$ and S is an equivalence relation, then the minimum number of elements to be added to R is n. Find the value of n.
Q. Let S be the set of positive integral value of a for which

[(ax2 + 2 (a + 1) x + 9a + 4) / (x2 + 8x + 32)] < 0 ∀x ∈ R.
Find the number of elements in S.

Q. The distance of the point Q(0,2,-2) from the line passing through the point P(5,-4,3) and perpendicular to the line r = (-3i + 2k) + λ(2i + 3j + 5k), λ ∈ R and r = (i - 2j + k) + μ (- i + 3j + 2k), μ ∈ R is?

Q. If one of the diameters of the circle x2 + y2 - 10x + 4y + 13 = 0 is a chord of another circle and whose center
is the point of intersection of the lines 2x + 3y = 12 and 3x - 2y = 5. then the radius of the circle is?

Q. An urn contains 15 red, 10 white, 60 orange, and 15 green balls. If 2 balls are taken with replacement, find the probability 1 ball is red and the other ball is white.Q4. lim (x→0) [(e|2sinx| - 2|sinx|-1) / x2] = ?

Q. If three vectors are:
a = 3i + j - 2k
b = 4i + j + 7k
c = i - 3j + 4k
If p is a vector such that p x b = c x b and p·a = 0, then find p·(i - j - k).

Q. Find the solution of the differential equation y dy/dx = x (logex - logey + 1), x > 0, y > 0 and passes through (e, 1).

Q. f(x) = (4x + 3)/(6x - 4) and g(x) = f(f(x)), then find g(g(g(g(x)))).

Q. For α, β, γ ≠ 0, if sin-1α + sin-1β + sin-1γ = π and (α + β + γ)*(α - γ + β) = 3αβ, then find the value of γ.

Q. If |a| = 1, |b| = 4 and a·b = 2. Also, c = (3a x b) - b and α is the angle between b and c, then what is the value of 192 sin2α?