JEE Main 2024 April 5 Shift 1 Chemistry Question Paper

Time Allowed :1 Hour	Maximum Marks :100	Total Questions :30

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The test is of 3 hours duration.
2. The question paper consists of 90 questions. The maximum marks are 300.
3. There are three parts in the question paper consisting of Physics, Chemistry and Mathematics having 30 questions in each part of equal weightage.
4. Each part (subject) has two sections.
   (i) Section-A: This section contains 20 multiple choice questions which have only one correct answer. Each question carries 4 marks for correct answer and –1 mark for wrong answer.
   (ii) Section-B: This section contains 10 questions. In Section-B, attempt any five questions out of 10. The answer to each of the questions is a numerical value. Each question carries 4 marks for correct answer and –1 mark for wrong answer. For Section-B, the answer should be rounded off to the nearest integer.

Chemistry

Question 1: The incorrect postulates of Dalton's atomic theory are:

(A) Atoms of different elements differ in mass.
(B) Matter consists of divisible atoms.
(C) Compounds are formed when atoms of different elements combine in a fixed ratio.
(D) All the atoms of a given element have different properties including mass.
(E) Chemical reactions involve the reorganization of atoms.

Choose the correct answer from the options given below:
Options:
(1) (B), (D), (E) only
(2) (A), (B), (D) only
(3) (C), (D), (E) only
(4) (B), (D) only

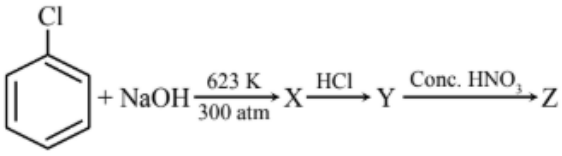
Question 2: The following reaction occurs in the Blast furnace where iron ore is reduced to iron metal:

$$Fe_2O_3(s) + 3CO(g) \rightleftharpoons Fe(l) + 3CO_2(g)$$

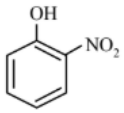
Using Le Chatelier's principle, predict which one of the following will *not* disturb the equilibrium.

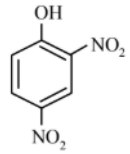
Options:
(1) Addition of Fe_2O_3
(2) Addition of CO_2
(3) Removal of CO
(4) Removal of CO_2

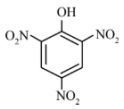
Question 3: Identify compound (Z) in the following reaction sequence.

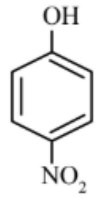


Options:

(1) 

(2) 

(3) 

(4) 

Question 4: Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason (R)
Assertion (A): Enthalpy of neutralisation of strong monobasic acid with strong monoacidic base is always -57 kJ mol^{-1}.
Reason (R): Enthalpy of neutralisation is the amount of heat liberated when one mole of H^+ ions furnished by acid combine with one mole of ^-OH ions furnished by base to form one mole of water.
In the light of the above statements, choose the correct answer from the options given below.

Options:
(1) (A) is true but (R) is false
(2) Both (A) and (R) are true and (R) is the correct explanation of (A)
(3) (A) is false but (R) is true
(4) Both (A) and (R) are true but (R) is not the correct explanation of (A)

Question 5: The statement(s) that are correct about the species O^{2-}, F^{-}, Na^{+}, and Mg^{2+}:

(A) All are isoelectronic
(B) All have the same nuclear charge
(C) O^{2-} has the largest ionic radii
(D) Mg^{2+} has the smallest ionic radii

Choose the most appropriate answer from the options given below:
Options:
(1) (B), (C) and (D) only
(2) (A), (B), (C) and (D)
(3) (C) and (D) only
(4) (A), (C) and (D) only

Question 6: For the compounds:

(A) $H_3C–CH_2–O–CH_2–CH_2–CH_3$

(B) $H_3C–CH_2–CH_2–CH_2–CH_3$

(C) $CH_3–CH_2–\underset{\underset{O}{\|}}{C}–CH_2–CH_3$

(D) $H_3C–\underset{\underset{OH}{|}}{CH}–CH_2–CH_2–CH_3$

The increasing order of boiling point is:
Choose the correct answer from the options given below:

Options:
(1) (A) < (B) < (C) < (D)
(2) (B) < (A) < (C) < (D)
(3) (D) < (C) < (A) < (B)
(4) (B) < (A) < (D) < (C)

Question 7: Given below are two statements:

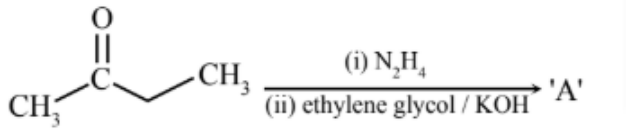
Statement I: In group 13, the stability of +1 oxidation state increases down the group.
Statement II: The atomic size of gallium is greater than that of aluminium.
In the light of the above statements, choose the most appropriate answer from the options given below:

Options:
(1) Statement I is incorrect but Statement II is correct
(2) Both Statement I and Statement II are correct
(3) Both Statement I and Statement II are incorrect
(4) Statement I is correct but Statement II is incorrect

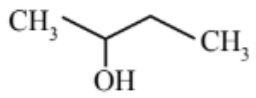
Question 8: Number of σ and π bonds present in ethylene molecule is respectively:

Options:
(1) 3 and 1
(2) 5 and 2
(3) 4 and 1
(4) 5 and 1

Question 9: Identify 'A' in the following reaction:



Options:

(1)


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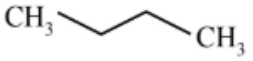

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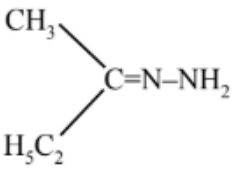

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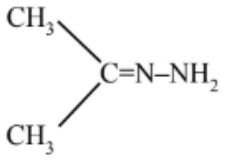


Question 10: The reaction at cathode in the cells commonly used in clocks involves.

Options:
(1) reduction of Mn from +4 to +3
(2) oxidation of Mn from +3 to +4
(3) reduction of Mn from +7 to +2
(4) oxidation of Mn from +2 to +7

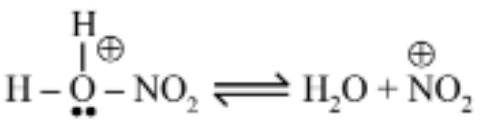
Question 11: Which one of the following complexes will exhibit the least paramagnetic behaviour?
[Atomic number, Cr = 24, Mn = 25, Fe = 26, Co = 27]

Options:
(1) $[Co(H_2O)_6]^{2+}$
(2) $[Fe(H_2O)_6]^{2+}$
(3) $[Mn(H_2O)_6]^{2+}$
(4) $[Cr(H_2O)_6]^{2+}$

Question 12: Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): *Cis* form of alkene is found to be more polar than the *trans* form.
Reason (R): Dipole moment of *trans* isomer of 2-butene is zero.
In the light of the above statements, choose the correct answer from the options given below:

Options:
(1) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)
(2) (A) is true but (R) is false
(3) Both (A) and (R) are true and (R) is the correct explanation of (A)
(4) (A) is false but (R) is true

Question 13: Given below are two statements:
Statement I: Nitration of benzene involves the following step –



Statement II: Use of Lewis base promotes the electrophilic substitution of benzene.
In the light of the above statements, choose the most appropriate answer from the options given below:

Options:
(1) Both Statement I and Statement II are incorrect
(2) Statement I is correct but Statement II is incorrect
(3) Both Statement I and Statement II are correct
(4) Statement I is incorrect but Statement II is correct

Question 14: The correct order of ligands arranged in increasing field strength.

Options:
(1) $Cl^- < {}^-OH < Br^- < CN^-$
(2) $F^- < Br^- < I^- < NH_3$
(3) $Br^- < F^- < H_2O < NH_3$
(4) $H_2O < {}^-OH < CN^- < NH_3$

Question 15: Which of the following gives a positive test with ninhydrin?

Options:
(1) Cellulose
(2) Starch
(3) Polyvinyl chloride
(4) Egg albumin

Question 16: The metal that shows highest and maximum number of oxidation state is:

Options:
(1) Fe
(2) Mn
(3) Ti
(4) Co

Question 17: An organic compound has 42.1% carbon, 6.4% hydrogen, and the remainder is oxygen. If its molecular weight is 342, then its molecular formula is:

Options:
(1) $C_{11}H_{18}O_{12}$
(2) $C_{12}H_{20}O_{12}$
(3) $C_{14}H_{20}O_{10}$
(4) $C_{12}H_{22}O_{11}$

Question 18: Given below are two statements:
Statement I: Bromination of phenol in solvents with low polarity such as $CHCl_3$ or CS_2 requires a Lewis acid catalyst.
Statement II: The Lewis acid catalyst polarizes the bromine to generate Br^+.
In the light of the above statements, choose the correct answer from the options given below:

Options:
(1) Statement I is true but Statement II is false.
(2) Both Statement I and Statement II are true
(3) Both Statement I and Statement II are false.
(4) Statement I is false but Statement II is true.

Question 19: Molar ionic conductivities of divalent cation and anion are 57 S cm^2 mol^{-1} and 73 S cm^2 mol^{-1} respectively. The molar conductivity of a solution of an electrolyte with the above cation and anion will be:

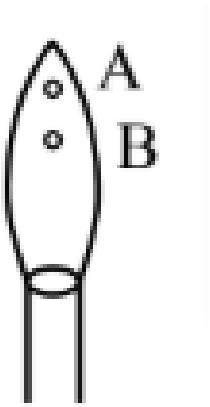
Options:
(1) 65 S cm^2 mol^{-1}
(2) 130 S cm^2 mol^{-1}
(3) 187 S cm^2 mol^{-1}
(4) 260 S cm^2 mol^{-1}

Question 20: The number of neutrons present in the more abundant isotope of boron is 'x'. Amorphous boron upon heating with air forms a product, in which the oxidation state of boron is 'y'. The value of x + y is ...

Options:
(1) 4
(2) 6
(3) 3
(4) 9

Question 21: The value of Rydberg constant (R_H) is 2.18×10^{-18} J. The velocity of electron having mass 9.1×10^{-31} kg in Bohr's first orbit of hydrogen atom $= \cdots \times 10^5$ ms^{-1} (nearest integer).

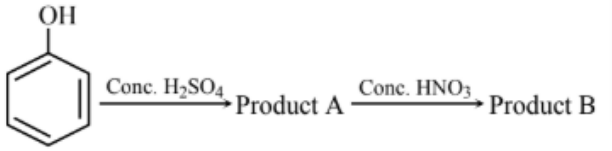
Question 22: In a borax bead test under hot conditions, a metal salt (one from the given) is heated at point B of the flame, resulted in a green colour salt bead. The spin-only magnetic moment value of the salt is ... BM (Nearest integer).



[Given atomic number of Cu = 29, Ni = 28, Mn = 25, Fe = 26]

Question 23: The heat of combustion of solid benzoic acid at constant volume is -321.30 kJ at 27°C. The heat of combustion at constant pressure is (-321.30 - xR) kJ. The value of x is ...

Question 24: Consider the given chemical reaction sequence:



Total sum of oxygen atoms in Product A and Product B are ...

Question 25: The spin only magnetic moment value of the ion among Ti^{2+}, V^{2+}, Co^{3+} and Cr^{2+}, that acts as strong oxidizing agent in aqueous solution is ... BM (Near integer).
(Given atomic numbers : Ti : 22, V : 23, Cr : 24, Co : 27)

Question 26: During the kinetic study of reaction 2A + B → C + D, the following results were obtained:

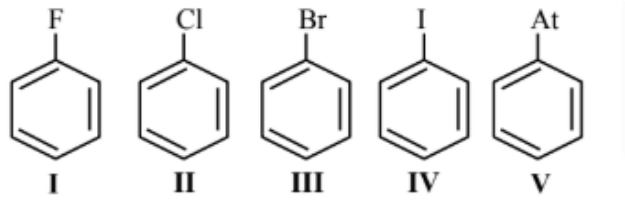
	[A] (M)	[B] (M)	Initial rate of formation of D
I	0.1	0.1	6.0×10^{-3}
II	0.3	0.2	7.2×10^{-2}
III	0.3	0.4	2.88×10^{-1}
IV	0.4	0.1	2.40×10^{-2}

Based on the above data, the overall order of the reaction is ...

Question 27: An artificial cell is made by encapsulating a 0.2 M glucose solution within a semipermeable membrane. The osmotic pressure developed when the artificial cell is placed within a 0.05 M solution of NaCl at 300 K is ____ $\times 10^{-1}$ bar. (Nearest Integer)
[Given: R = 0.083 L bar mol^{-1} K^{-1}]

Assume complete dissociation of NaCl

Question 28: The number of halobenzenes from the following that can be prepared by Sandmeyer's reaction is ...



Question 29: In the Lewis dot structure for NO_2^-, the total number of valence electrons around nitrogen is ...

Question 30: 9.3 g of pure aniline is treated with bromine water at room temperature to give a white precipitate of the product 'P'. The mass of product 'P' obtained is 26.4 g. The percentage yield is ... %.
