

CBSE Sample Papers for Class 11 Chemistry Set 1 with Solutions

Time Allowed : 3 hours

Maximum Marks: 70

General Instructions:

There are 33 questions in this question paper with internal choice.

Section – A consists of 16 multiple -choice questions carrying 1 mark each.

Section – B consists of 5 short answer questions carrying 2 marks each. ,

Section – C consists of 7 short answer questions carrying 3 marks each.

Section – D consists of 2 case – based questions carrying 4 marks each.

Section – E consists of 3 long answer questions carrying 5 marks each.

All questions are compulsory.

Use of log tables and calculators is not allowed.

Section-A

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

Questions 1.

What will be the molarity of a solution, which contains 5.85 g of NaCl(s) per 500 mL?

(A) 4 mol L<sup>-1</sup>

(B) 20 mol L<sup>-1</sup>

(C) 0.2 mol L<sup>-1</sup>

(D) 2 mol L<sup>-1</sup>

Answer:

(C) 0.2 mol L<sup>-1</sup>

Explanation:

Weight of NaCl (w) = 5.85g

Volume of solution (V) = 500 mL

Molecular weight of NaCl = 58.5

Molarity =  $\frac{w \times 1000}{\text{Molecular weight} \times \text{Volume in mL}}$  =  $\frac{5.85 \times 1000}{58.5 \times 500} = 0.2 \text{ mol L}^{-1}$

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Questions 2.

The empirical formula and molecular mass of a compound are CH<sub>2</sub>O and 180 g respectively. What will be the molecular formula of the compound?

(A) C<sub>9</sub>H<sub>18</sub>O<sub>9</sub>

(B) CH<sub>2</sub>O

(C) C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>

(D) C<sub>2</sub>H<sub>4</sub>O<sub>2</sub>

Answer:

(C) C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>

Explanation:

Empirical formula mass (CH<sub>2</sub>O)

= 12 + 2(1) + 16 = 30

Molecular mass = 180

Molecular mass 180

$n = \frac{\text{Molecular mass}}{\text{Empirical formula mass}} = \frac{180}{30} = 6$

∴ Molecular formula = n x empirical formula

= 6 x CH<sub>2</sub>O = C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>

Questions 3.

Which of the following conclusions could not be derived from Rutherford's  $\alpha$ -particle scattering experiment?

- (A) Most of the space in the atom is empty.
- (B) The radius of the atom is about  $10^{-10}$  m while that of nucleus is  $10^{-15}$  m.
- (C) Electrons move in a circular path of fixed energy called orbits.
- (D) Electrons and the nucleus are held together by electrostatic forces of attraction.

Answer:

- (C) Electrons move in a circular path of fixed energy called orbits.

Explanation:

The concept of movement of electrons in circular path of fixed energy called orbits was given by Bohr.

Questions 4.

The number of radial nodes for 3p orbital is .....

- (A) 3
- (B) 4
- (C) 2
- (D) 1

Answer:

- (D) 1

Explanation:

For 3p sub-shell,  $n = 3$ ,  $l = 1$

Number of radial nodes =  $n - l - 1 = 3 - 1 - 1 = 1$

Questions 5.

Consider the isoelectronic species,  $\text{Na}^+$ ,  $\text{Mg}^{2+}$ ,  $\text{F}^-$  and  $\text{O}^{2-}$ . The correct order of increasing length of their radii is .....

- (A)  $\text{F}^- < \text{O}^- < \text{Mg}^{2+} < \text{Na}^+$
- (B)  $\text{Mg}^{2+} < \text{Na}^+ < \text{F}^- < \text{O}^{2-}$
- (C)  $\text{O}^{2-} < \text{F}^- < \text{Na}^+ < \text{Mg}^{2+}$
- (D)  $\text{O}^{2-} < \text{F}^- < \text{Mg}^{2+} < \text{Na}^+$

Answer:

- (B)  $\text{Mg}^{2+} < \text{Na}^+ < \text{F}^- < \text{O}^{2-}$

Explanation:

The radii of cations and anions forming an isoelectronic series decreases with an increase in nuclear charge.

Questions 6.

Isostructural species are those which have the same shape and hybridization. Among the given species identify the isostructural pairs.

- (A)  $[\text{NF}_3 \text{ and } \text{BF}_3]$
- (B)  $[\text{BF}_4^- \text{ and } \text{NH}_4^+]$
- (C)  $[\text{BCl}_3 \text{ and } \text{BrCl}_3]$
- (D)  $[\text{NH}_2 \text{ and } \text{NO}_3^-]$

Answer:

- (B)  $[\text{BF}_4^- \text{ and } \text{NH}_4^+]$

Explanation:

- (i)  $\text{NF}_3$  is pyramidal whereas  $\text{BF}_3$  is trigonal planar.
- (ii)  $\text{BF}_4^-$  and  $\text{NH}_4^+$  are tetrahedral.
- (iii)  $\text{BCl}_3$  is triangular planar whereas  $\text{BrCl}_3$  is pyramidal.

(iv)  $\text{NH}_3$  is pyramidal whereas  $\text{NO}_3$  is triangular planar.

Questions 7.

The types of hybrid orbitals of nitrogen in  $\text{NO}_2^+$ ,  $\text{NO}_3^-$  and  $\text{NH}_4^+$  respectively are expected to be:

(A) sp,  $\text{sp}^3$  and  $\text{sp}^2$

(B) sp,  $\text{sp}^2$ , and  $\text{sp}^3$

(C)  $\text{sp}^2$ , sp and  $\text{sp}^3$

(D)  $\text{sp}^2$ ,  $\text{sp}^3$  and sp

Answer:

(B) sp,  $\text{sp}^2$ , and  $\text{sp}^3$

Explanation:

Number of orbitals involved in hybridization (H) =  $\frac{1}{2} [ V + M - C + A ]$

where V = valence electrons of central atom

M = no. of monovalent atoms linked with central atom

C = charge of cation

A = charge of anion

$\text{NO}_2^+ = \frac{1}{2} [ 5 + 0 - 1 + 0 ] = 2$  or sp

$\text{NO}_3^- = \frac{1}{2} [ 5 + 0 - 0 + 1 ] = 3$  or  $\text{sp}^2$

$\text{NH}_4^+ = \frac{1}{2} [ 5 + 4 - 1 + 0 ] = 4$  or  $\text{sp}^3$

Questions 8.

Choose the correct answer.

A thermodynamic state function is a quantity :

(A) used to determine heat changes.

(B) whose value is independent of path.

(C) used to determine pressure volume work.

(D) whose value depends on temperature only.

Answer:

(B) whose value is independent of path.

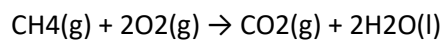
Explanation:

State function does not depend upon the path followed or is independent of the path followed.

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Questions 9.

$\Delta U^\circ$  of combustion of methane is  $-X$  kJ mol<sup>-1</sup>



The value of  $\Delta H^\circ$  is :

(A)  $= \Delta U^\circ$

(B)  $> \Delta U^\circ$

(C)  $< \Delta U^\circ$

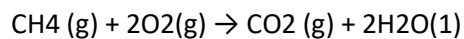
(D)  $= 0$

Answer:

(C)  $< \Delta U^\circ$

Explanation:

$$\Delta H^\circ = \Delta U^\circ + \Delta nRT$$



$$\Delta n = n_p - n_R = 1 - 3 = -2$$

$$\Delta H = -\Delta U - 2RT$$

$$\Delta H^\circ < \Delta U^\circ$$

Questions 10. Among halogens, the correct order of amount of energy released in electron gain (electron gain enthalpy) is: (A)  $F > Cl > Br > I$

(B)  $F < Cl < Br < I$

(C)  $F < Cl > Br > I$

(D)  $F < Cl < Br < I$

Answer:

(C)  $F < Cl > Br > I$

Explanation: In a group, electron gain enthalpy decreases while moving down but electron gain enthalpy of Cl is more negative than F. This happens due to addition of electron to 2p orbital which results in greater repulsion than adding an electron to 3p orbital.

Questions 11.

We know that the relationship between  $K_c/$  and  $K_p$  is

$$K_p = K_c / (RT)^{\Delta n}$$

What would be the value of  $\Delta n$  for the reaction:



(A) 1

(B) 0.5

(C) 1.5

(D) 2

Answer:

(B) 0.5

Explanation:

$$\Delta n = (\text{Number of moles of gaseous products}) - (\text{Number of moles of gaseous reactants}) = 2 - 0 = 2$$

Questions 12.

For the reaction  $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$ , the standard free energy is  $\Delta G^\ominus$ . The equilibrium constant (K) would be:

(A)  $K = 0$

(B)  $K > 1$

(C)  $K = 1$

(D)  $K < 1$  Answer: (B)  $K > 1$

Explanation:

$\Delta G^\ominus = -RT \ln K$ .  $\Delta G^\ominus > 0$  means  $\Delta G^\ominus$  is positive. This is possible only if  $\ln K$  is negative, i.e.,  $K < 1$ .

Questions 13.

Given below are two statements labelled as Assertion (A) and Reason (R).

Assertion (A): Simple distillation can help in separating a mixture of propan-1-ol (boiling point  $97^\circ\text{C}$ ) and propanone (boiling point  $56^\circ\text{C}$ ).

Reason (R): Liquids with a difference of more than  $20^\circ\text{C}$  in their boiling points can be separated by simple distillation. Select the most appropriate answer from the options given below:

(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

Answer:

(A) Both A and R are true and R is the correct explanation of A.



Questions 14.

Assertion (A): Generally, ionization enthalpy increases from left to right in a period.

Reason (R): When successive electrons are added to the orbitals in the same principal quantum level, the shielding effect of inner core of electrons does not increase very much to compensate for the increased attraction of the electron to the nucleus. Select the most appropriate answer from the options given below:

- (A) Both A and R are true and R is the correct explanation of A.
- (B) Both A and R are true but R is not the correct explanation of A.
- (C) A is true but R is false.
- (D) A is false but R is true.

Answer:

- (A) Both A and R are true and R is the correct explanation of A.

Explanation:

Assertion and reason both are correct statements and reason is correct explanation of ' assertion

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Questions 15.

Assertion (A): The compound cyclooctane has the following structural formula: It is cyclic and has conjugated  $8\pi$  -electron system but it is not an aromatic compound.

Reason (R):  $(4n + 2) n$  electrons rule does not hold good and ring is not planar.

Select the most appropriate answer from the options given below:

- (A) Both A and R are true and R is the correct explanation of A.
- (B) Both A and R are true but R is not the correct explanation of A.
- (C) A is true but R is false.
- (D) A is false but R is true.

Answer:

(A) Both A and R are true and R is the correct explanation of A.

Questions 16.

Assertion (A): Toluene on Friedal-Crafts methylation gives o- and p-xylene.

Reason (R): CH<sub>3</sub>-group bonded to benzene ring increases electron density at o- and p- position. Select the most appropriate answer from the options given below:

(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

Answer:

(A) Both A and R are true and R is the correct explanation of A.

Section-B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

Questions 17.

(a) Give the balanced chemical equation for combustion of Methane gas.

(b) Calculate the amount of water (g) produced by the combustion of 16 g of methane.

Answer:

The balanced equation for combustion of methane is-

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(b) 1 mole of CH<sub>4</sub>(g) gives 2 mol of H<sub>2</sub>O(g)

2 moles of water (H<sub>2</sub>O)

$$= 2 \times (2 + 16) = 2 \times 18 = 36\text{g}$$

$$1 \text{ mole H}_2\text{O} = 18\text{g H}_2\text{O} \Rightarrow 18 \text{ gH}_2\text{O} 1 \text{ molH}_2\text{O}$$

$\therefore$  Amount of water produced by the combustion of 16g of methane = 2 mol H<sub>2</sub>O x 18 gH<sub>2</sub>O 1 molH<sub>2</sub>O

$$= 2 \times 18\text{g H}_2\text{O} = 36\text{g H}_2\text{O}$$

Questions 18.

Mention the physical significance of  $\Psi$  and  $\Psi^2$ .

Answer:

Physical significance of  $\Psi$ :

All the information about the electron in an atom is stored in its orbital wave function  $\Psi$  and quantum mechanics makes it possible to extract this information out of  $\Psi$ . (1)

Physical significance of  $\Psi^2$ :

From the value of  $|\Psi|^2$  at different points within an atom, it is possible to predict the region around the nucleus where electron will most probably be found. (1)

Questions 19.

(a) Which has maximum bond angle?

CH<sub>4</sub>, BeCl<sub>2</sub>, NH<sub>3</sub>.

(b) Arrange the above compounds in decreasing order of bond angle.

Answer:

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