Group-14 Elements: Carbon family

SINGLE CORRECT CHOICE TYPE QUESTIONS

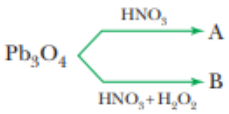
1. Which of the following elements was used in Biblical times on the floor in the Hanging gardens of Babylon (one of the wonders of the ancient world)?
(A) Sn (B) Pb (C) Si (D) C

2. The lowest melting solid among the following elements is
(A) Si (B) Pb (C) Ge (D) Sn

3. Which of the following carbides consists of C_3^{4-} type of anionic part?
(A) Al_4C_3 (B) CaC_2 (C) B_4C (D) Mg_2C_3

4. Which of the following factors is mainly responsible for toxicity of CO gas?
(A) It has very high calorific value.
(B) It readily combines with O_2 to form CO_2.
(C) It readily forms a complex with haemoglobin in the blood, which is 300 times more stable than oxyhaemoglobin complex.
(D) CO is sparingly soluble in water.

5. In the following reactions, the Pb compounds A and B are respectively



(A) $Pb(NO_3)_2 + PbO_2$ and $Pb(NO_3)_2$
(B) $Pb(NO_3)_2$ and $Pb(NO_3)_2$
(C) PbO_2 and $Pb(NO_3)_2$
(D) $Pb(NO_3)_2$ and $PbO_2 + Pb(NO_3)_2$

6. When hot conc. NaCl solution is electrolysed in absence of PbO with severe stirring, the product obtained is
(A) Pb_3O_4 (B) Pb_2O_3
(C) PbO_2 (D) $NaClO_3$

7. In which of the following reactions $PbSO_4$ is formed?
(A) $PbO_2 + SO_2$
(B) $PbS + O_3$
(C) $PbS + H_2O_2$
(D) All of the above.

8. SnO_2 is insoluble in
(A) conc. HCl
(B) hot HNO_3
(C) aqua regia
(D) All of the above.

9. The water repelling characteristic of silicones is due to
(A) the presence of alkyl group pointed towards surface.
(B) strong Si–O–Si-bonds.
(C) low surface area.
(D) high van der Waal's forces.

MULTIPLE CORRECT CHOICE TYPE QUESTIONS

1. Which of the following properties decrease for interstitial carbides as compared to that of the parent metal?
(A) Malleability (B) Hardness
(C) Ductility (D) Density

2. Which of the following properties remain the same with the parent metal for the interstitial carbides?
(A) Ductility (B) Metallic lustre
(C) Electric conductivity (D) Hardness

3. The constituent gases present in coal gas are
(A) CO (B) H_2 (C) CH_4 (D) CO_2

4. Which of the following Group 14 elements have diamond type structure?
(A) Si (B) Ge (C) Sn (D) Pb

5. Which of the following compounds can be used for the detection of CO_2?
(A) $Ca(OH)_2$ (B) Na_2CO_3
(C) $Ba(OH)_2$ (D) H_2O

6. Which of the following carbonates are thermally more stable as compared to $MgCO_3$?
(A) $BeCO_3$ (B) $SrCO_3$
(C) $CaCO_3$ (D) $BaCO_3$

COMPREHENSION TYPE QUESTIONS

Passage 1: For Questions 1 – 3

CO_2 is an acidic oxide and reacts with bases forming two series of salts bicarbonates and carbonates. CO_2 dissolves in water also, slightly, to form H_2CO_3.

1. When CO_2 dissolves in water, the ions that are present in equilibrium are
(A) CO_3^{2-}
(B) HCO_3^-
(C) H_3O^+
(D) All of these

2. A hydrate of CO_2 can also be formed at 0°C under a pressure of 50 atm of CO_2. The formula of the hydrate of CO_2 is
(A) $CO_2 \cdot 2H_2O$
(B) $CO_2 \cdot 4H_2O$
(C) $CO_2 \cdot 6H_2O$
(D) $CO_2 \cdot 8H_2O$

3. Again H_2O and CO_2 are used by plants in a different manner during photosynthesis. The products of photosynthesis are
(A) $C_6H_{12}O_6 + O_2$
(B) $C_{12}H_{22}O_{11} + O_2$
(C) $C_{12}O_{22}O_{11} + H_2$
(D) $C_6H_{12}O_6 + N_2$

Passage 2: For Questions 4 – 5

$$\text{Natural gas } (CH_4) + \text{Sulphur} \xrightarrow[\text{catalysed by } Al_2O_3 \text{ or silica gel}]{600^\circ C} A + H_2S$$

Compound A can also be prepared by heating charcoal and sulphur vapour at about 850°C.

4. Which of the following properties are correct for A?.
(A) It is highly inflammable.
(B) It is very poisonous, affecting brain and central nervous system.
(C) It is a colourless volatile liquid having very low flash point (30°C).
(D) All of these

5. For the following reaction, which of the following statements is incorrect regarding B and C?

$$A + NaOH \text{ solution} \rightarrow B + C + H_2O$$

(A) Both B and C have planar anionic part.
(B) B and C are isoelectronic (total number of electrons).
(C) Both B and C are ionic compounds.
(D) None of these

Passage 3: For Questions 6 – 7

I. $\text{Red solid (A)} + HNO_3 \rightarrow \text{Neutral liquid (B)} + C + \underset{\text{brown ppt.}}{D}$

II. $C\,(\text{solution}) + H_2S \rightarrow \underset{\text{black ppt.}}{E}$

III. D is a very good oxidizing agent.

IV. $D + SO_2 \rightarrow$ white solid (F) which is insoluble in dilute mineral acid.

V. Compound A is an oxide of lead

6. The formula of D is
(A) PbO
(B) $Pb(NO_3)_2$
(C) PbO_2
(D) $PbO{\cdot}PbO_2$

7. F can be converted into E when F is treated with
(A) dil. HCl
(B) H_2S
(C) coke powder (red hot)
(D) sulphur powder

ASSERTION–REASONING TYPE QUESTIONS

In the following set of questions, a Statement I is given and a corresponding Statement II is given below it. Mark the correct answer as:
(A) If both Statement I and Statement II are true and Statement II is the correct explanation of Statement I.
(B) If both Statement I and Statement II are true but Statement II is not the correct explanation for Statement I.
(C) If Statement I is true but Statement II is false.
(D) If Statement I is false but Statement II is true.

1. Statement I: Ag_2CO_3 is slightly yellow or yellowish white in colour.

Statement II: Ag^+ has strong polarizing power.

2. Statement I: The IE_1 of Pb is greater than that of Sn.

Statement II: The radius of Pb is greater than that of Sn.

3. Statement I: Water gas has higher calorific value compared to producer gas.

Statement II: All constituents of producer gas may act as good fuel.

4. Statement I: $I_2O_5 + 5CO \rightarrow I_2 + 5CO_2$
$I_2 + 2S_2O_3^{2-} \rightarrow 2I^- + S_4O_6^{2-}$
The number of equivalent of $S_2O_3^{2-}$
= number of equivalent of I_2
= number of equivalent of CO

Statement II: The above set of reactions falls under the category of iodometry reactions.

5. Statement I: The formula for interstitial carbide formed by transition metals is MC.

Statement II: Transition metals are in general crystallized in the form of fcc or hcp pattern and all octahedral voids are occupied by carbon atom.

6. Statement I: Mg_2C_3 is a C_3 - type of ionic carbide.

Statement II: Mg_2C_3 consists of three carbon atoms in one formula unit.

7. Statement I: Silane is more reactive than methane.

Statement II: The Si and C atoms are both sp^3 hybridized in the two compounds.

8. Statement I: SiO_2 is not isostructural with CO_2.

Statement II: The formation of $3p_\pi - 2p_\pi$ is not as effective as formation of $2p_\pi - 2p_\pi$ in CO_2.

9. Statement I: Silicones have water repelling characteristics.

Statement II: (Si–O–Si) skeleton is covered with alkyl groups.

10. Statement I: $2PbO_2 + 2H_2SO_4 \rightarrow 2PbSO_4 + 2H_2O + O_2$
In this reaction H_2SO_4 acts as reducing agent.

Statement II: If PbO_2 is considered as lead peroxide, then above reaction is an example of disproportionation reaction.

INTEGER ANSWER TYPE QUESTIONS

The answer to each of the following questions is a non-negative integer.

1. Find the number of C–C linkages in C_{60}.
2. Find the number of six membered rings in C_{84}.
3. How many of the Group14 elements have higher value of IE_1 as compared to Pb?
4. Among the following, find the number of elements that show catenation property.
   C, Si, P, S, O, N, Ge
5. Find the number of Fe – C bonds in $Fe_2(CO)_9$.
6. Find the difference in number of σ bonds in the reactant and products when ammonium carbonate is heated.
7. Find the number of planar species from the following.
   CO_3^{2-}, $COCl_2$, SiO_4^{2-}, C_3O_2, HCO_3^-, CS_3^{2-}, C_3S_2
8. When SnC_2O_4 is heated in absence of air, find the difference in oxidation states of carbon atoms in gaseous products.
9. Find the number of acidic oxides from the following.
   CO, GeO, SnO, PbO_2, SnO_2, GeO_2, SiO_2
10. Find the number of water of crystallization in molecule of butter of tin.

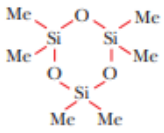
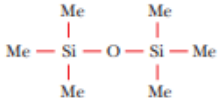
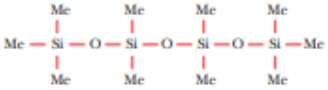
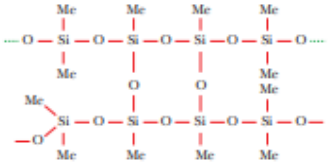
MATRIX–MATCH TYPE QUESTIONS

In each of the following questions, statements are given in two columns, which have to be matched. The statements in Column I are labelled as **(A), (B), (C)** and **(D)**, while those in Column II are labelled as **(P), (Q), (R), (S)** and **(T)**. Any given statement in Column I can have correct matching with *one or more* statements in Column II.

1. Match the type of silicon with the example.

Column I	Column II
(A) Neso-silicate	(P) $Zn_4(OH)$ $[Si_2O_7]$, Hemimorphite
(B) Phyllo-silicate	(Q) $Mg_3(OH)_2[(Si_2O_5)_2]$, Tale
(C) Soro-silicate	(R) $Na_2Fe_3^{II}Fe_2^{III}[(Si_4O_{11})_2](OH)_2$, Crocidolite
(D) Amphibole-silicate	(S) $Be_2[Be_2SiO_4]$ Phenacite

2. Match the chlorosilanes with the compounds they yield on hydrolysis.

Column I	Column II
(A) 	(P) Only Me_2SiCl_2
(B) 	(Q) Me_2SiCl_2 + Me_3SiCl
(C) 	(R) Me_2SiCl_2 + $MeSiCl_3$
(D) 	(S) Only Me_3SiCl

3. Match the reaction with the nature of the product obtained.

Column I	Column II
(A) Diamond	(P) All atoms are sp^2 hybridized.
(B) Graphite	(Q) d_{C-C} is maximum.
(C) Fullerene	(R) Does not exist as discrete molecules.
	(S) Ring structure is existing.

ANSWERS

Single Correct Choice Type Questions

1. (B)	**3.** (D)	**5.** (A)	**7.** (D)	**9.** (A)
2. (D)	**4.** (C)	**6.** (D)	**8.** (D)	

Multiple Correct Choice Type Questions

1. (A), (C)	**3.** (A), (B), (C), (D)	**5.** (A), (C)
2. (B), (C)	**4.** (A), (B), (C)	**6.** (B), (C), (D

Comprehension Type Questions

1. (D)	**3.** (A)	**5.** (B)	**7.** (C)
2. (D)	**4.** (D)	**6.** (C)	

Assertion–Reasoning Type Questions

1. (A)	**3.** (C)	**5.** (A)	**7.** (B)	**9.** (A)
2. (B)	**4.** (D)	**6.** (B)	**8.** (A)	**10.** (D)

Integer Answer Type Questions

1. 90	**3.** 3	**5.** 12	**7.** 6	**9.** 3
2. 32	**4.** 7	**6.** 1	**8.** 2	**10.** 5

Matrix–Match Type Questions

1. (A) → (S)
(B) → (Q)
(C) → (P)
(D) → (R)

2. (A) → (P)
(B) → (S)
(C) → (Q)
(D) → (R)

3. (A) → (Q), (R), (S)
(B) → (P), (R), (S)
(C) → (P), (S)