

# AIPMT 2011 Mains — Chemistry Question Paper with Solutions

27 Chemistry questions as set in the paper · answers checked by RankUp

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**1. Which of the statements about "Denaturation" given below are correct?**

- (a) Denaturation of proteins causes loss of secondary and tertiary structures of the protein
- (b) Denaturation leads to the conversion of double strand of DNA into single strand
- (c) Denaturation affects primary structure which gets distorted

- (A) (a) and (b)
- (B) (a), (b) and (c)
- (C) (b) and (c)
- (D) (a) and (c)

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**2. The IUPAC name of the compound  $\text{ClC}(\text{CH}_3)=\text{C}(\text{I})\text{CH}_2\text{CH}_3$ , in which Cl and I lie on opposite sides of the double bond, is**

- (A) trans-3-iodo-4-chloro-3-pentene
- (B) cis-3-chloro-3-iodo-2-pentene
- (C) trans-2-chloro-3-iodo-2-pentene
- (D) cis-3-iodo-4-chloro-3-pentene

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**3. Which of the following compounds undergoes nucleophilic substitution reaction most easily?**

- (A) p-Chloroanisole ( $\text{p-Cl-C}_6\text{H}_4\text{-OCH}_3$ )
- (B) Chlorobenzene ( $\text{C}_6\text{H}_5\text{Cl}$ )
- (C) p-Nitrochlorobenzene ( $\text{p-Cl-C}_6\text{H}_4\text{-NO}_2$ )
- (D) p-Chlorotoluene ( $\text{p-Cl-C}_6\text{H}_4\text{-CH}_3$ )

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**4. An organic compound 'A' on treatment with  $\text{NH}_3$  gives 'B' which on heating gives 'C'. 'C' when treated with  $\text{Br}_2$  in the presence of KOH produces ethylamine.**

**Compound 'A' is**

- (A)  $\text{CH}_3\text{-CH}(\text{CH}_3)\text{-COOH}$
- (B)  $\text{CH}_3\text{CH}_2\text{COOH}$
- (C)  $\text{CH}_3\text{COOH}$
- (D)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$

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**5. Consider the following processes:**

**$(1/2)\text{A} \rightarrow \text{B}; \Delta H = +150 \text{ kJ/mol}$**

**$3\text{B} \rightarrow 2\text{C} + \text{D}; \Delta H = -125 \text{ kJ/mol}$**

**$\text{E} + \text{A} \rightarrow 2\text{D}; \Delta H = +350 \text{ kJ/mol}$**

**For  $\text{B} + \text{D} \rightarrow \text{E} + 2\text{C}$ ,  $\Delta H$  will be**

- (A)  $-325 \text{ kJ/mol}$
- (B)  $325 \text{ kJ/mol}$
- (C)  $525 \text{ kJ/mol}$
- (D)  $-175 \text{ kJ/mol}$

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**6. A 0.1 molal aqueous solution of a weak acid is 30% ionized. If  $K_f$  for water is  $1.86^\circ\text{C/m}$ , the freezing point of the solution will be**

- (A)  $-0.36^\circ\text{C}$
- (B)  $-0.24^\circ\text{C}$
- (C)  $-0.18^\circ\text{C}$
- (D)  $-0.54^\circ\text{C}$

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**7. In qualitative analysis, the metals of group I can be separated from other ions by precipitating them as chloride salts. A solution initially contains  $\text{Ag}^+$  and  $\text{Pb}^{2+}$  at a concentration of 0.10 M. Aqueous HCl is added to this solution until the  $\text{Cl}^-$  concentration is 0.10 M. What will the concentrations of  $\text{Ag}^+$  and  $\text{Pb}^{2+}$  be at equilibrium? ( $K_{sp}$  for  $\text{AgCl} = 1.8 \times 10^{-10}$ ,  $K_{sp}$  for  $\text{PbCl}_2 = 1.7 \times 10^{-5}$ )**

- (A)  $[\text{Ag}^+] = 1.8 \times 10^{-9} \text{ M}$ ,  $[\text{Pb}^{2+}] = 1.7 \times 10^{-3} \text{ M}$
- (B)  $[\text{Ag}^+] = 1.8 \times 10^{-11} \text{ M}$ ,  $[\text{Pb}^{2+}] = 1.7 \times 10^{-4} \text{ M}$
- (C)  $[\text{Ag}^+] = 1.8 \times 10^{-7} \text{ M}$ ,  $[\text{Pb}^{2+}] = 1.7 \times 10^{-6} \text{ M}$
- (D)  $[\text{Ag}^+] = 1.8 \times 10^{-11} \text{ M}$ ,  $[\text{Pb}^{2+}] = 8.5 \times 10^{-5} \text{ M}$

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**8. The unit of rate constant for a zero order reaction is**

- (A)  $\text{L}^2 \text{ mol}^{-2} \text{ s}^{-1}$
- (B)  $\text{s}^{-1}$
- (C)  $\text{mol L}^{-1} \text{ s}^{-1}$
- (D)  $\text{L mol}^{-1} \text{ s}^{-1}$

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**9. 200 mL of an aqueous solution of a protein contains 1.26 g of the protein. The osmotic pressure of this solution at 300 K is found to be  $2.57 \times 10^{-3} \text{ bar}$ . The molar mass of protein will be ( $R = 0.083 \text{ L bar mol}^{-1} \text{ K}^{-1}$ )**

- (A)  $31011 \text{ g mol}^{-1}$
- (B)  $61038 \text{ g mol}^{-1}$
- (C)  $51022 \text{ g mol}^{-1}$
- (D)  $122044 \text{ g mol}^{-1}$

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**10. The rate of the reaction  $2\text{N}_2\text{O}_5 \rightarrow 4\text{NO}_2 + \text{O}_2$  can be written in three ways:**

$$-\frac{d[\text{N}_2\text{O}_5]}{dt} = k[\text{N}_2\text{O}_5]$$

$$\frac{d[\text{NO}_2]}{dt} = k'[\text{N}_2\text{O}_5]$$

$$\frac{d[\text{O}_2]}{dt} = k''[\text{N}_2\text{O}_5]$$

**The relationship between  $k$  and  $k'$  and between  $k$  and  $k''$  are**

- (A)  $k' = 2k$ ;  $k'' = 2k$
- (B)  $k' = k$ ;  $k'' = k$
- (C)  $k' = 2k$ ;  $k'' = k$
- (D)  $k' = 2k$ ;  $k'' = k/2$

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**11. The half life of a substance in a certain enzyme-catalysed reaction is 138 s. The time required for the concentration of the substance to fall from  $1.28 \text{ mg L}^{-1}$  to  $0.04 \text{ mg L}^{-1}$  is**

- (A) 690 s
- (B) 276 s
- (C) 414 s
- (D) 552 s

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**12. Which of the following complex compounds will exhibit highest paramagnetic behaviour? (At. No. Ti = 22, Cr = 24, Co = 27, Zn = 30)**

- (A)  $[\text{Co}(\text{NH}_3)_6]^{3+}$
- (B)  $[\text{Zn}(\text{NH}_3)_6]^{2+}$
- (C)  $[\text{Ti}(\text{NH}_3)_6]^{3+}$
- (D)  $[\text{Cr}(\text{NH}_3)_6]^{3+}$

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**13. Which of the following is not a fat soluble vitamin?**

- (A) Vitamin E
- (B) Vitamin A
- (C) Vitamin B complex
- (D) Vitamin D

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**14. Match List-I with List-II for the composition of substances and select the correct answer using the code given below the lists.**

**List-I: (A) Plaster of paris (B) Epsomite (C) Kieserite (D) Gypsum**

**List-II: (i)  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$  (ii)  $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$  (iii)  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$  (iv)  $\text{MgSO}_4 \cdot \text{H}_2\text{O}$  (v)  $\text{CaSO}_4$**

- (A) A(i), B(ii), C(iii), D(iv)
- (B) A(iv), B(iii), C(ii), D(i)
- (C) A(iii), B(iv), C(i), D(ii)
- (D) A(ii), B(iii), C(iv), D(i)

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**15. Which of the following compounds is most basic?**

- (A) Acetanilide ( $\text{C}_6\text{H}_5\text{-NH-COCH}_3$ )
- (B) Aniline ( $\text{C}_6\text{H}_5\text{-NH}_2$ )
- (C) p-Nitroaniline ( $\text{O}_2\text{N-C}_6\text{H}_4\text{-NH}_2$ )
- (D) Benzylamine ( $\text{C}_6\text{H}_5\text{-CH}_2\text{NH}_2$ )

AIPMT 2011 Mains · Q92

**16. Which of the following statements is incorrect?**

- (A) Aluminium reacts with excess NaOH to give  $\text{Al}(\text{OH})_3$
- (B)  $\text{NaHCO}_3$  on heating gives  $\text{Na}_2\text{CO}_3$
- (C) Pure sodium metal dissolves in liquid ammonia to give blue solution
- (D) NaOH reacts with glass to give sodium silicate

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**17. Which has the maximum number of molecules among the following?**

- (A) 8 g  $\text{H}_2$
- (B) 64 g  $\text{SO}_2$
- (C) 44 g  $\text{CO}_2$
- (D) 48 g  $\text{O}_3$

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**18. Match the compounds given in List-I with List-II and select the suitable option using the code given below.**

**List-I: a. Benzaldehyde, b. Phthalic anhydride, c. Phenyl benzoate, d. Methyl salicylate**

**List-II: (i) Phenolphthalein, (ii) Benzoin condensation, (iii) Oil of wintergreen, (iv) Fries rearrangement**

- (A) a(ii), b(iii), c(iv), d(i)
- (B) a(ii), b(i), c(iv), d(iii)
- (C) a(iv), b(i), c(iii), d(ii)
- (D) a(iv), b(ii), c(iii), d(i)

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**19. What is the value of electron gain enthalpy of  $\text{Na}^+$  if  $\text{IE}_1$  of  $\text{Na} = 5.1 \text{ eV}$ ?**

- (A)  $+2.55 \text{ eV}$
- (B)  $+10.2 \text{ eV}$
- (C)  $-5.1 \text{ eV}$
- (D)  $-10.2 \text{ eV}$

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**20. Which of the following oxide is amphoteric?**

- (A)  $\text{SiO}_2$
- (B)  $\text{CO}_2$
- (C)  $\text{SnO}_2$
- (D)  $\text{CaO}$

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**21. Which of the following carbonyls will have the strongest C - O bond?**

- (A)  $\text{V}(\text{CO})_6^-$
- (B)  $\text{Fe}(\text{CO})_5$
- (C)  $\text{Mn}(\text{CO})_6^+$
- (D)  $\text{Cr}(\text{CO})_6$

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**22. The order of reactivity of phenyl magnesium bromide ( $\text{PhMgBr}$ ) with the following compounds:**

**(I)  $\text{CH}_3\text{CHO}$ , (II)  $(\text{CH}_3)_2\text{C}=\text{O}$  and (III)  $\text{Ph}_2\text{C}=\text{O}$  is**

- (A)  $\text{I} > \text{III} > \text{II}$
- (B)  $\text{I} > \text{II} > \text{III}$
- (C)  $\text{III} > \text{II} > \text{I}$
- (D)  $\text{II} > \text{I} > \text{III}$

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**23. A bubble of air is underwater at temperature  $15^\circ\text{C}$  and the pressure 1.5 bar. If the bubble rises to the surface where the temperature is  $25^\circ\text{C}$  and the pressure is 1.0 bar what will happen to the volume of the bubble?**

- (A) Volume will become smaller by a factor of 0.70
- (B) Volume will become greater by a factor of 2.5
- (C) Volume will become greater by a factor of 1.6
- (D) Volume will become greater by a factor of 1.1

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**24. The pairs of species of oxygen and their magnetic behaviours are noted below. Which of the following presents the correct description?**

- (A)  $\text{O}_2^+$ ,  $\text{O}_2^-$  – Both paramagnetic
- (B)  $\text{O}$ ,  $\text{O}_2^{2-}$  – Both paramagnetic
- (C)  $\text{O}_2^-$ ,  $\text{O}_2^{2-}$  – Both diamagnetic
- (D)  $\text{O}^+$ ,  $\text{O}_2^{2-}$  – Both paramagnetic

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**25. According to the Bohr Theory, which of the following transitions in the hydrogen atom will give rise to the least energetic photon?**

- (A)  $n = 6$  to  $n = 5$
- (B)  $n = 5$  to  $n = 3$
- (C)  $n = 6$  to  $n = 1$
- (D)  $n = 5$  to  $n = 4$

**26. The following reactions take place in the blast furnace in the preparation of impure iron. Identify the reaction pertaining to the formation of the slag.**

- (A)  $\text{CaO(s)} + \text{SiO}_2\text{(s)} \rightarrow \text{CaSiO}_3\text{(s)}$   
 (B)  $2\text{C(s)} + \text{O}_2\text{(g)} \rightarrow 2\text{CO(g)}$   
 (C)  $\text{Fe}_2\text{O}_3\text{(s)} + 3\text{CO(g)} \rightarrow 2\text{Fe(l)} + 3\text{CO}_2\text{(g)}$   
 (D)  $\text{CaCO}_3\text{(s)} \rightarrow \text{CaO(s)} + \text{CO}_2\text{(g)}$

**27. A solid compound XY has NaCl structure. If the radius of the cation is 100 pm, the radius of the anion ( $\text{Y}^-$ ) will be**

- (A) 241.5 pm  
 (B) 165.7 pm  
 (C) 275.1 pm  
 (D) 322.5 pm

## Answer key and explanations

### 1. Answer: (A) (a) and (b)

Denaturation disrupts the secondary and tertiary structure of a protein, and in DNA it separates the double helix into single strands. Peptide bonds are not broken, so the primary structure is unchanged; any combination including that statement is wrong.

### 2. Answer: (C) trans-2-chloro-3-iodo-2-pentene

The longest chain containing the double bond has five carbons, numbered from the end nearer the double bond: C2 carries Cl and C3 carries I, giving 2-chloro-3-iodopent-2-ene. Cl and I, the heavier substituents on each alkene carbon, are on opposite sides, so it is trans. Names like 3-iodo-4-chloro-3-pentene number from the wrong end.

### 3. Answer: (C) p-Nitrochlorobenzene ( $\text{p-Cl-C}_6\text{H}_4\text{-NO}_2$ )

Aryl halides undergo nucleophilic substitution only when electron-withdrawing groups at ortho/para positions stabilise the negatively charged intermediate. A para  $-\text{NO}_2$  does this strongly, so p-nitrochlorobenzene reacts most easily.  $-\text{OCH}_3$  and  $-\text{CH}_3$  donate electrons and make substitution harder than in chlorobenzene.

### 4. Answer: (B) $\text{CH}_3\text{CH}_2\text{COOH}$

Hoffmann bromamide degradation removes one carbon, so ethylamine must come from propanamide (compound 'C'), which forms on heating ammonium propanoate ('B'), made from propanoic acid ('A') and  $\text{NH}_3$ . Acetic acid would give methylamine and butanoic acid would give propylamine.

### 5. Answer: (D) $-175 \text{ kJ/mol}$

Double the first equation ( $\text{A} \rightarrow 2\text{B}$ ,  $+300$ ), add the second ( $3\text{B} \rightarrow 2\text{C} + \text{D}$ ,  $-125$ ) and reverse the third ( $2\text{D} \rightarrow \text{E} + \text{A}$ ,  $-350$ ). Adding gives  $\text{B} + \text{D} \rightarrow \text{E} + 2\text{C}$  with  $\Delta H = 300 - 125 - 350 = -175 \text{ kJ/mol}$ . Forgetting to double the first equation leads to  $-325 \text{ kJ/mol}$ .

### 6. Answer: (B) $-0.24^\circ\text{C}$

$\text{HA} \rightleftharpoons \text{H}^+ + \text{A}^-$  with  $\alpha = 0.3$  gives  $i = 1 + \alpha = 1.3$ .  $\Delta T_f = iK_f m = 1.3 \times 1.86 \times 0.1 = 0.24^\circ\text{C}$ , so the freezing point is  $-0.24^\circ\text{C}$ . Ignoring ionisation gives  $-0.18^\circ\text{C}$ , and taking full dissociation gives  $-0.36^\circ\text{C}$ .

### 7. Answer: (A) $[\text{Ag}^+] = 1.8 \times 10^{-9} \text{ M}$ , $[\text{Pb}^{2+}] = 1.7 \times 10^{-3} \text{ M}$

At  $[\text{Cl}^-] = 0.10 \text{ M}$ :  $[\text{Ag}^+] = K_{\text{sp}}/[\text{Cl}^-] = 1.8 \times 10^{-10}/0.1 = 1.8 \times 10^{-9} \text{ M}$  and  $[\text{Pb}^{2+}] = K_{\text{sp}}/[\text{Cl}^-]^2 = 1.7 \times 10^{-5}/0.01 = 1.7 \times 10^{-3} \text{ M}$ . Choices that use  $[\text{Cl}^-]$  instead of  $[\text{Cl}^-]^2$  for  $\text{PbCl}_2$  give  $1.7 \times 10^{-4} \text{ M}$ , which is wrong.

### 8. Answer: (C) $\text{mol L}^{-1} \text{ s}^{-1}$

For a zero-order reaction rate  $= k[\text{A}]^0 = k$ , so  $k$  has the units of rate,  $\text{mol L}^{-1} \text{ s}^{-1}$ .  $\text{s}^{-1}$  is the first-order unit and  $\text{L mol}^{-1} \text{ s}^{-1}$  is the second-order unit.

### 9. Answer: (B) $61038 \text{ g mol}^{-1}$

$\pi = (w/M)RT/V$ , so  $M = wRT/(\pi V) = 1.26 \times 0.083 \times 300/(2.57 \times 10^{-3} \times 0.200) = 31.37/5.14 \times 10^{-4} \approx 61038 \text{ g mol}^{-1}$ . Forgetting to convert 200 mL to 0.200 L or halving/doubling the volume gives the other values.

### 10. Answer: (D) $k' = 2k$ ; $k'' = k/2$

Rate  $= -\frac{1}{2} d[\text{N}_2\text{O}_5]/dt = \frac{1}{4} d[\text{NO}_2]/dt = d[\text{O}_2]/dt$ . So  $d[\text{NO}_2]/dt = 2 \times (-d[\text{N}_2\text{O}_5]/dt)$ , giving  $k' = 2k$ , and  $d[\text{O}_2]/dt = \frac{1}{2} \times (-d[\text{N}_2\text{O}_5]/dt)$ , giving  $k'' = k/2$ . Setting all three constants equal ignores the stoichiometric coefficients.

**11. Answer: (A) 690 s**

A constant half-life means first-order kinetics.  $1.28/0.04 = 32 = 2^5$ , so five half-lives are needed:  $5 \times 138 = 690$  s. 552 s corresponds to only four half-lives.

**12. Answer: (D)  $[\text{Cr}(\text{NH}_3)_6]^{3+}$**

$\text{Cr}^{3+}$  is  $d^3$  with 3 unpaired electrons in octahedral complexes.  $\text{Co}^{3+}$  ( $d^6$ ) with  $\text{NH}_3$  is low spin with no unpaired electrons,  $\text{Zn}^{2+}$  is  $d^{10}$  with none, and  $\text{Ti}^{3+}$  is  $d^1$  with one. So  $[\text{Cr}(\text{NH}_3)_6]^{3+}$  is the most paramagnetic.

**13. Answer: (C) Vitamin B complex**

Vitamins A, D, E and K are fat soluble, while the B-complex vitamins and vitamin C are water soluble. So vitamin B complex is not fat soluble.

**14. Answer: (D) A(ii), B(iii), C(iv), D(i)**

Plaster of Paris is  $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ , epsomite is  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ , kieserite is  $\text{MgSO}_4 \cdot \text{H}_2\text{O}$  and gypsum is  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ . Anhydrous  $\text{CaSO}_4$  is a distractor that matches none of them. Mixing up gypsum and plaster of Paris is the usual trap.

**15. Answer: (D) Benzylamine ( $\text{C}_6\text{H}_5\text{-CH}_2\text{NH}_2$ )**

In benzylamine the  $\text{-NH}_2$  is attached to a  $\text{CH}_2$  group, so its lone pair is not delocalised into the ring and it behaves like an alkylamine. In aniline the lone pair is delocalised into the ring, a para  $\text{-NO}_2$  withdraws it further, and in acetanilide it is also delocalised into the  $\text{C=O}$  group, so these are much weaker bases.

**16. Answer: (A) Aluminium reacts with excess NaOH to give  $\text{Al}(\text{OH})_3$**

Aluminium dissolves in excess NaOH to give sodium aluminate,  $\text{Na}[\text{Al}(\text{OH})_4]$ , and  $\text{H}_2$ ; any  $\text{Al}(\text{OH})_3$  formed redissolves, so that statement is incorrect.  $\text{NaHCO}_3$  does decompose to  $\text{Na}_2\text{CO}_3$  on heating, sodium gives a blue solution in liquid ammonia (ammoniated electrons), and NaOH attacks glass to form sodium silicate.

**17. Answer: (A) 8 g  $\text{H}_2$**

Moles: 8 g  $\text{H}_2 = 8/2 = 4$  mol; 64 g  $\text{SO}_2$ , 44 g  $\text{CO}_2$  and 48 g  $\text{O}_3$  are each 1 mol. The largest number of moles means the most molecules, so 8 g of  $\text{H}_2$  has the most, even though it has the smallest mass.

**18. Answer: (B) a(ii), b(i), c(iv), d(iii)**

Benzaldehyde undergoes benzoin condensation; phthalic anhydride condenses with phenol to give phenolphthalein; phenyl benzoate undergoes Fries rearrangement to hydroxybenzophenones; methyl salicylate is oil of wintergreen. Only one code gives all four pairs correctly.

**19. Answer: (C) -5.1 eV**

$\text{Na}^+ + e^- \rightarrow \text{Na}$  is exactly the reverse of  $\text{Na} \rightarrow \text{Na}^+ + e^-$  ( $I_{E1} = 5.1$  eV), so energy is released and  $\Delta_{\text{eg}}H = -5.1$  eV. +2.55 eV or  $\pm 10.2$  eV come from wrongly halving or doubling the ionisation energy.

**20. Answer: (C)  $\text{SnO}_2$**

$\text{SnO}_2$  reacts with both acids and bases, so it is amphoteric.  $\text{SiO}_2$  and  $\text{CO}_2$  are acidic oxides and  $\text{CaO}$  is a basic oxide.

**21. Answer: (C)  $\text{Mn}(\text{CO})_6^+$**

Back-donation from metal d orbitals into  $\text{CO } \pi^*$  orbitals weakens the C-O bond. The positive charge in  $\text{Mn}(\text{CO})_6^+$  holds the metal electrons tightly, so back-bonding is least and the C-O bond is strongest. The anion  $\text{V}(\text{CO})_6^-$  has the most back-bonding and the weakest C-O bond.

**22. Answer: (B) I > II > III**

Nucleophilic addition of  $\text{PhMgBr}$  gets slower as electron-donating and bulky groups around the carbonyl carbon increase. Acetaldehyde (one H, one  $\text{CH}_3$ ) is most reactive, acetone (two  $\text{CH}_3$ ) is next, and benzophenone (two bulky phenyls with resonance) is least reactive: I > II > III.

**23. Answer: (C) Volume will become greater by a factor of 1.6**

From  $P_1V_1/T_1 = P_2V_2/T_2$ :  $V_2/V_1 = (P_1/P_2)(T_2/T_1) = (1.5/1.0)(298/288) = 1.55 \approx 1.6$ . Using Celsius temperatures or ignoring the temperature change gives the other factors, and the volume cannot get smaller since both changes make it expand.

**24. Answer: (A)  $\text{O}_2^+$ ,  $\text{O}_2$  - Both paramagnetic**

By MO theory  $\text{O}_2$  has 2 unpaired electrons and  $\text{O}_2^+$  has 1, so both are paramagnetic.  $\text{O}_2^{2-}$  has all electrons paired (diamagnetic), so the pairings with peroxide as paramagnetic are wrong, and  $\text{O}_2^-$  has 1 unpaired electron, so calling it diamagnetic is wrong.

**25. Answer: (A) n = 6 to n = 5**

$\Delta E \propto (1/n_1^2 - 1/n_2^2)$ : for  $6 \rightarrow 5$  it is  $1/25 - 1/36 = 0.0122$ , for  $5 \rightarrow 4$  it is  $1/16 - 1/25 = 0.0225$ , and the others are larger. So the  $6 \rightarrow 5$  transition gives the least energetic photon.

**26. Answer: (A)  $\text{CaO(s)} + \text{SiO}_2\text{(s)} \rightarrow \text{CaSiO}_3\text{(s)}$**

Slag is the fusible calcium silicate made when the flux CaO combines with the silica gangue:  $\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3$ . Decomposition of limestone only supplies CaO, the carbon reaction makes the CO reducing agent, and  $\text{Fe}_2\text{O}_3 + 3\text{CO}$  is the reduction step.

**27. Answer: (A) 241.5 pm**

In the NaCl (octahedral) structure the limiting radius ratio  $r^+/r^- = 0.414$ , so  $r^- = 100/0.414 \approx 241.5$  pm. Using 0.732 (the CsCl value) or 0.225 (tetrahedral) gives the other radii.

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