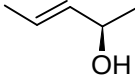


RAMAKRISHNA MISSION VIVEKANANDA CENTENARY COLLEGE, RAHARA, KOLKATA
Undergraduate Admission Test: Chemistry Honours

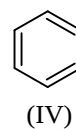
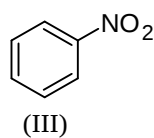
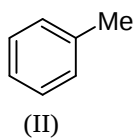
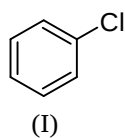
Full Marks : 75

Time : 1 hour

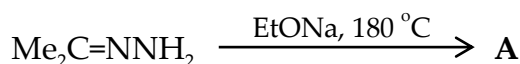
1. The energy of an electron in the 3rd orbit of hydrogen atom is “- E”. The energy of an electron in the first orbit will be:
- (a) - 3E
 - (b) - E/3
 - (c) - E/9
 - (d) - 9E
2. The root mean square velocity of hydrogen is $\sqrt{7}$ times the root mean square velocity of nitrogen. If T is the temperature of the gas in absolute scale, which of the following is true?
- (a) $T_{N_2} = T_{H_2}$
 - (b) $T_{H_2} = (\sqrt{7})T_{N_2}$
 - (c) $T_{N_2} = 2 \times T_{H_2}$
 - (d) $T_{N_2} = (\sqrt{7}) T_{H_2}$
3. The coefficient of thermal expansion (α) is defined as, $\alpha = \frac{1}{V} \left(\frac{\partial V}{\partial T} \right)_p$. For an ideal gas, α is equal to
- (a) T
 - (b) P
 - (c) 1/P
 - (d) 1/T
4. Given that, $C + O_2 \rightarrow CO_2$ $\Delta H_1^\circ = -x \text{ kJ}$
 $2CO + O_2 \rightarrow 2CO_2$ $\Delta H_2^\circ = -y \text{ kJ}$
The enthalpy of formation (in kJ per mole) of CO will be,
- (a) $(y - 2x)/2$
 - (b) $(2x - y)$
 - (c) $(y - 2x)$
 - (d) $(2x - y)/2$
5. For the reaction, $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$, what is the value of ΔH ?
- (a) $\Delta U + RT$
 - (b) $\Delta U + 2RT$
 - (c) $\Delta U - RT$
 - (d) $\Delta U - 2RT$

6. $\text{N}_2 + 3 \text{H}_2 \rightleftharpoons 2 \text{NH}_3$ (equilibrium constant = K_1)
 $\text{N}_2 + \text{O}_2 \rightleftharpoons 2 \text{NO}$ (equilibrium constant = K_2)
 $\text{H}_2 + \frac{1}{2} \text{O}_2 \rightleftharpoons \text{H}_2\text{O}$ (equilibrium constant = K_3)
 The equilibrium constant of the following reaction:
 $2\text{NH}_3 + \frac{5}{2} \text{O}_2 \rightleftharpoons 2 \text{NO} + 3 \text{H}_2\text{O}$, in terms of K_1 , K_2 and K_3 is
 (a) $K_1 K_2 K_3$
 (b) $(K_1 K_2)/K_3$
 (c) $(K_1 K_3^2)/K_2$
 (d) $(K_2 K_3^3)/K_1$
7. 2 mole of N_2 is mixed with 6 mole of H_2 in a closed vessel of 1 litre capacity at a certain temperature. If 50% of N_2 is converted into NH_3 at equilibrium, the value of K_C for the reaction, $\text{N}_2(\text{g}) + 3 \text{H}_2(\text{g}) \rightleftharpoons 2 \text{NH}_3(\text{g})$, is
 (a) $4/27$
 (b) 9
 (c) 27
 (d) $1/27$
8. Relationship between atomic radius (r) and the edge length (a) of a body centred cubic unit cell is,
 (a) $r = a/2$
 (b) $r = \sqrt{a}/\sqrt{2}$
 (c) $r = (\sqrt{3})a/4$
 (d) $r = 3a/2$
9. Nitration of benzene with mixed acid is a
 (a) single step reaction
 (b) two step reaction of which the second step is slower
 (c) two step reaction of which the first step is slower
 (d) two step reaction involving an anionic σ - complex
10. The following compound is named as

 (a) (2R,3E)-pent-3-en-2-ol
 (b) (2S,3E)-pent-3-en-2-ol
 (c) (2R,3Z)-pent-3-en-2-ol
 (d) (2E,4R)-pent-2-en-4-ol

11. Correct order of reactivity towards electrophilic substitution of the following compounds is



- (a) I > IV > II > III
(b) II > I > III > IV
(c) II > IV > I > III
(d) I > II > III > IV
12. Identify 'A' from the following options-



- (a) MeCH_2Me
(b) $\text{Me}_2\text{C}=\text{NH}$
(c) $\text{Me}_2\text{C}(\text{OEt})\text{NH}_2$
(d) Me_2CHNH_2
13. 2-Pentanone and 3-pentanone can be distinguished by –
- (a) Ammoniacal cuprous chloride
(b) DNP solution
(c) NaOH / I_2
(d) Fehling's solution.
14. Which of the following compounds can undergo aldol condensation?
i. Acetone ii. Formaldehyde iii. Propanal iv. Benzaldehyde
- (a) i, iv
(b) i, iii
(c) i, ii
(d) ii, iv

15. Arrange the following compounds according to increasing boiling point.
i. n-pentane ii. neo-pentane iii. n-pentanol iv. sodium n-pentoxide
- (a) i < ii < iii < iv
(b) iv < ii < iii < i
(c) ii < i < iii < iv
(d) iii < iv < ii < i

16. Arrange the following compounds according to increasing acidic strength.
i. p-nitrophenol ii. p-cresol iii. phenol iv. benzoic acid
- (a) $ii < iii < i < iv$
(b) $iv < ii < iii < i$
(c) $ii < i < iii < iv$
(d) $iii < iv < ii < i$
17. Among Li, Na, Al and Ba which one has the highest reducing property:
- (a) Li
(b) Na
(c) Al
(d) Ba
18. Among F_2 , O_2 , Cl_2 and $KMnO_4$ which one has the highest oxidizing property:
- (a) O_2
(b) F_2
(c) Cl_2
(d) $KMnO_4$
19. Aqueous solution of a colorless crystalline solid **A** gives white precipitate (**B**) when treated with dilute NaOH solution. The precipitate readily dissolves in excess of the reagent, forming **C**, to give a colorless solution. This colorless solution is further treated with dilute CH_3COOH and H_2S is passed through it subsequently. A white precipitate (**D**) is obtained again. Identify **A** and **D**.
- (a) $A = MgSO_4 \cdot 7H_2O$; $D = MgS$
(b) $A = BaSO_4$; $D = BaS$
(c) $A = ZnSO_4 \cdot 7H_2O$; $D = ZnS$
(d) $A = Al_2(SO_4)_3 \cdot 16H_2O$; $D = Al_2S_3$
20. Identify the value of x_1, x_2, x_3 and x_4 for the following redox reaction.
- $$Cr_2O_7^{2-} + x_1 Fe^{2+} + x_2 H^+ = 2Cr^{3+} + x_3 Fe^{3+} + x_4 H_2O$$
- (a) $x_1 = 3, x_2 = 12, x_3 = 6, x_4 = 6$
(b) $x_1 = 6, x_2 = 14, x_3 = 6, x_4 = 7$
(c) $x_1 = 6, x_2 = 12, x_3 = 3, x_4 = 6$
(d) $x_1 = 3, x_2 = 14, x_3 = 3, x_4 = 7$

21. 8 g of a radioactive substance is reduced to 0.5 g in 1 hour. What is the half-life period ($t_{1/2}$) of the substance?

- (a) 15 minutes
- (b) 10 minutes
- (c) 45 minutes
- (d) 30 minutes

22. $^{235}\text{U}_{92} + {}^1_0\text{n} \rightarrow {}^{146}\text{Ba}_{56} + \dots + 3 {}^1_0\text{n}$.

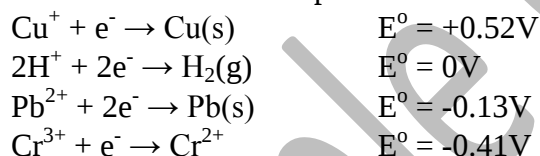
For the above reaction, what will be the missing element?

- (a) $^{87}\text{Ge}_{32}$
- (b) $^{89}\text{Br}_{35}$
- (c) $^{87}\text{Kr}_{36}$
- (d) $^{89}\text{Br}_{35}$.

23. What is the normality of a 0.05 M solution of H_3PO_4 ?

- (a) 0.05
- (b) 0.1
- (c) 0.15
- (d) none of them

24. The standard reduction potentials of few systems are given below:



Which of the following reaction would be expected to occur?

- (a) $2\text{Cu(s)} + \text{Pb}^{2+} \rightarrow 2\text{Cu}^+ + \text{Pb(s)}$
- (b) $\text{Pb}^{2+} + \text{H}_2(\text{g}) \rightarrow \text{Pb(s)} + 2\text{H}^+$
- (c) $2\text{Cr}^{2+} + \text{Pb}^{2+} \rightarrow \text{Pb(s)} + 2\text{Cr}^{3+}$
- (d) $\text{Pb(s)} + 2\text{Cr}^{3+} \rightarrow 2\text{Cr}^{2+} + \text{Pb}^{2+}$

25. Which one of the following does not follow the Lewis octet rule?

- (a) NO_3^-
- (b) NO
- (c) CO_2
- (d) BH_4^-