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Department of Education - Western Province

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය - 2023

General Certificate of Education (Advanced Level) Examination - 2023

13 ශ්‍රේණිය - පෙරහුරු ප්‍රශ්න පත්‍රය - 2023 දෙසැම්බර්

Grade 13 – Practice Paper – 2023 December

රසායන විද්‍යාව I Chemistry I		02 E I	පැය දෙකයි *Two hours*

Universal gas constant	R	=	$8.314\ J\ K^{-1}\ mol^{-1}$
Avogadro constant	N_A	=	$6.022 \times 10^{23}\ mol^{-1}$
Planck's constant	h	=	$6.626 \times 10^{-34}\ J\ s$
Velocity of light	C	=	$3 \times 10^{8}\ ms^{-1}$

❖ **Answer all questions**

1. The correct response shows the number of orbitals having the principle quantum number (n) = 4 and magnetic quantum number (m_l) = +1 is,

(1) 1 (2) 3 (3) 4 (4) 5 (5) 6

2. Which of the following is a false relation between the discovery given and the scientist involved?

(1) Discovery of election – J.J. Thomson

(2) Presenting of nuclear model – Ernest Rutherford

(3) Discovery of neutron – James Chadwick

(4) Experimental determination of the charge of electron – G.J. Stoney

(5) Presenting of the atomic energy shell model – Niels Bohr

3. Which of the following correctly shows the shape around Xe and the valency of Xe in $XeOF_4$?

(1) Trigonal bipyramidal – 6

(2) Square pyramidal – 6

(3) Octahedral – 6

(4) Square pyramidal – 8

(5) Octahedral – 8

4. The correct increasing order of the radius is,

(1) $Cl^- < S^{2-} < P^{3-} < Ca^{2+} < K^+$

(2) $Mg^{2+} < Na^+ < Ca^{2+} < Sr^{2+} < K^+$

(3) $Ne < F^- < O^{2-} < S^{2-} < Cl^-$

(4) $Be^{2+} < Li^+ < Mg^{2+} < Ca^{2+} < Na^+$

(5) $O < C < Be < B < Li$

5. The composition of Cl^- ions in an aqueous solution of $FeCl_3.Al_2(SO_4)_3.6KCl$ is 71 ppm. What is the concentration of SO_4^{2-} ions in ppm of the solution? (R.A.M. Fe = 56, Cl = 35.5, Al = 27, S = 32, O = 16, K = 39)

(1) 576 (2) 192 (3) 96 (4) 64 (5) 21.3

6. $A_{(g)} + 3e \longrightarrow A^{3-}_{(g)}$; $\Delta H_1^{\Theta} = +543 \text{ kJ mol}^{-1}$

$A^{-}_{(g)} + e \longrightarrow A^{2-}_{(g)}$; $\Delta H_2^{\Theta} = +143 \text{ kJ mol}^{-1}$

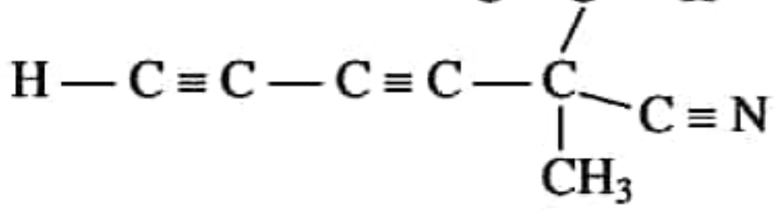
$A^{2-}_{(g)} + e \longrightarrow A^{3-}_{(g)}$; $\Delta H_3^{\Theta} = +448 \text{ kJ mol}^{-1}$

According to the data above, the first electron gain energy of 'A' is,

(1) -48 kJ mol^{-1} (3) -96 kJ mol^{-1} (5) $+238 \text{ kJ mol}^{-1}$

(2) $+48 \text{ kJ mol}^{-1}$ (4) $+96 \text{ kJ mol}^{-1}$

7. What is the IUPAC name of the following compound?



(1) 2 – cyano – 2 – methylhex – 3, 5 – diynal

(2) 2 – cyano – 2 – methylhexa – 3, 5 – diynal

(3) 2 – oxo – 2 – methyl – 3, 5 – hexadiynnitrile

(4) 2 – formyl – 2 – methylhex – 3, 5 – diynnitrile

(5) 2 – formyl – 2 – methylhexa – 3, 5 – diynnitrile

8. Magnesium nitride is formed by reacting 12 g of Mg metal with nitrogen in air. What is the volume taken by released NH_3 at standard temperature and pressure when the product formed above is treated with water?

(Consider that the volume of one mole of ammonia taken place at s.t.p. as 22.4 dm^3)

(Mg = 24, H = 1, O = 16, N = 14)

(1) 3.74 dm^3 (3) 11.20 dm^3 (5) 18.67 dm^3

(2) 7.47 dm^3 (4) 14.93 dm^3

9. Which of the following ion is having an overlapping between non-hybridized p and d orbitals to form a pi (π) bond between atoms?

(1) NO_3^- (2) CO_3^{2-} (3) PO_4^{3-} (4) NO_2^- (5) AlO_2^-

10. Which of the following could not be used to reduce $MnO_4^- \longrightarrow Mn^{2+}$ in acidic medium?

(1) Fe^{2+} (2) $C_2O_4^{2-}$ (3) H_2S (4) SO_4^{2-} (5) H_2O_2

11. Which of the following solution could not be used to distinguish between aqueous solutions of Na_2SO_3 and $Na_2S_2O_3$?

(1) Na_2CO_3 (3) $Pb(NO_3)_2$ (5) H_2SO_4

(2) $AgNO_3$ (4) HCl

12. $2A_{(g)} + 3B_{(g)} \longrightarrow nC_{(g)} + 4D_{(l)} + E_{(g)} \quad \Delta H^{\Theta} = -56\ kJ\ mol^{-1}$

If the reactions above is spontaneous at all temperatures, the most suitable value standing for 'n' is,

(1) 1 (2) 2 (3) 3 (4) 4 (5) 5

13. Excess of $Ag_2SO_{4(s)}$, $BaSO_{4(s)}$ and $Ba_3(PO_4)_{2(s)}$ are shaken with distilled water and allowed to reach equilibrium. Which of the following relation is true, if it is assumed as aqueous ions are not gone under hydrolysis?

(1) $[Ag^{+}_{(aq)}] + 2[Ba^{2+}_{(aq)}] = 2[SO_4^{2-}{}_{(aq)}] + 3[PO_4^{3-}{}_{(aq)}]$

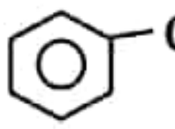
(2) $2[Ag^{+}_{(aq)}] + 4[Ba^{2+}_{(aq)}] = 2[SO_4^{2-}{}_{(aq)}] + 2[PO_4^{3-}{}_{(aq)}]$

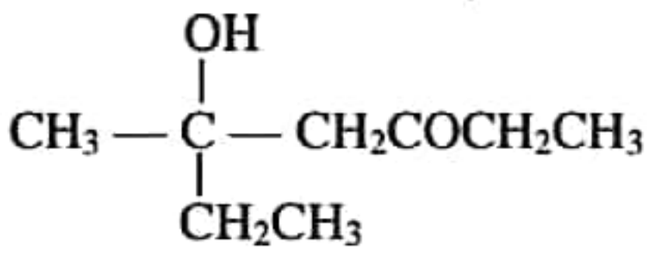
(3) $2[Ag^{+}_{(aq)}] + 3[Ba^{2+}_{(aq)}] = 2[SO_4^{2-}{}_{(aq)}] + 2[PO_4^{3-}{}_{(aq)}]$

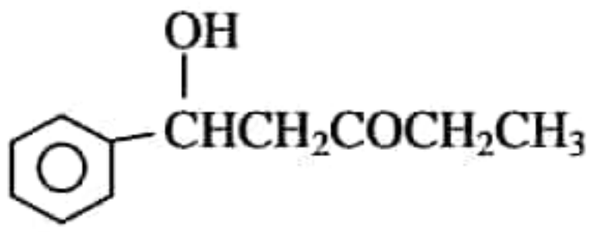
(4) $[Ag^{+}_{(aq)}] + [Ba^{2+}_{(aq)}] = [SO_4^{2-}{}_{(aq)}] + [PO_4^{3-}{}_{(aq)}]$

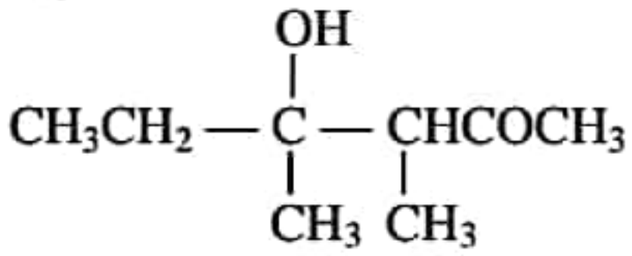
(5) $2[Ag^{+}_{(aq)}] + 4[Ba^{2+}_{(aq)}] = 2[SO_4^{2-}{}_{(aq)}] + 2[PO_4^{3-}{}_{(aq)}]$

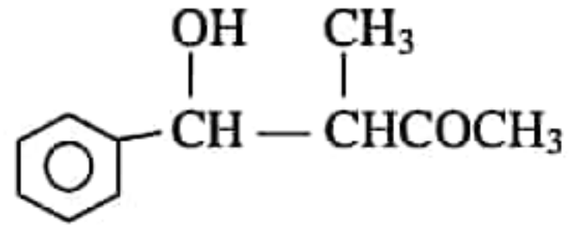
14. Which of the following is not a product formed when the mixture given is treated with aqueous NaOH?

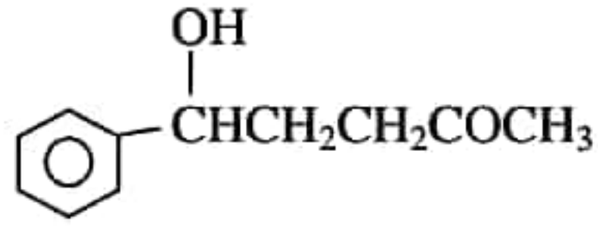
$CH_3CH_2COCH_3 +$  $\longrightarrow$

(1) 

(2) 

(3) 

(4) 

(5) 

15. $2N_2O_{5(g)} \longrightarrow 4NO_{2(g)} + O_{2(g)}$

At 60°C temperature, the rate constant for the reaction above is $1.20 \times 10^{-3} s^{-1}$. What is the concentration of $N_2O_{5(g)}$ required to reach the initial rate 1.08×10^{-4} $moldm^{-3}s^{-1}$ at the same temperature?

(1) 0.03 $moldm^{-3}$

(2) 0.09 $moldm^{-3}$

(3) 0.12 $moldm^{-3}$

(4) 0.30 $moldm^{-3}$

(5) 0.48 $moldm^{-3}$

16. Select the correct statement regarding to the following reactions.

(1) N_2O and H_2SO_4 are formed by the reaction between sulphur and conc. HNO_3.

(2) N_2 is formed when NH_4NO_3 is heated.

(3) N_2 is liberated when CuO reacts with NH_3.

(4) In acidic media H_2O_2 transforms $Fe^{3+} \longrightarrow Fe^{2+}$.

(5) H_3PO_3 is formed by PCl_5 reacting with excess water.

17. At constant temperature, the equilibrium constant (Kp) for the decomposition

$N_2O_{4(g)} \rightleftharpoons 2NO_{2(g)}$ is expressed by $Kp = \frac{4\alpha^2P}{1-\alpha^2}$

When P = pressure and α = molar decomposition amount, which of the following is true?

(1) Kp increases with increase of P

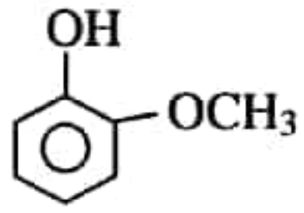
(2) Kp increases with increase of α

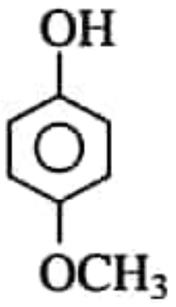
(3) Kp increases with decrease of α

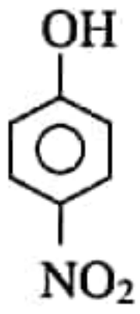
(4) Kp remains constant with change in p and α

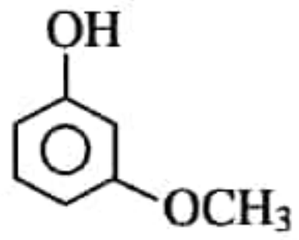
(5) P increases with increase of α

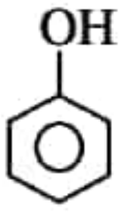
18. Which of the following is least acidic?

(1) 

(3) 

(5) 

(2) 

(4) 

19. At 25°C temperature Ag_2CrO_4 just begins to precipitate when equal volumes of 1.0×10^{-4} moldm^{-3} $Ag_2SO_{4(aq)}$ and 4.0×10^{-4} moldm^{-3} $K_2CrO_{4(aq)}$ are mixed together. What is the approximate ksp value of Ag_2CrO_4?

(1) 5×10^{-13} mol^{3}dm^{-9} (3) 4×10^{-12} mol^{3}dm^{-9} (5) 4×10^{-8} mol^{3}dm^{-9}

(2) 2×10^{-12} mol^{3}dm^{-9} (4) 4×10^{-10} mol^{3}dm^{-9}

20. A dilute solution of H_2SO_4 is electrolyzed using 0.200 A current. How long does it spend to liberate 0.003 mol of H_2 gas at the cathode? (lF = 96500 Cmol^{-1})

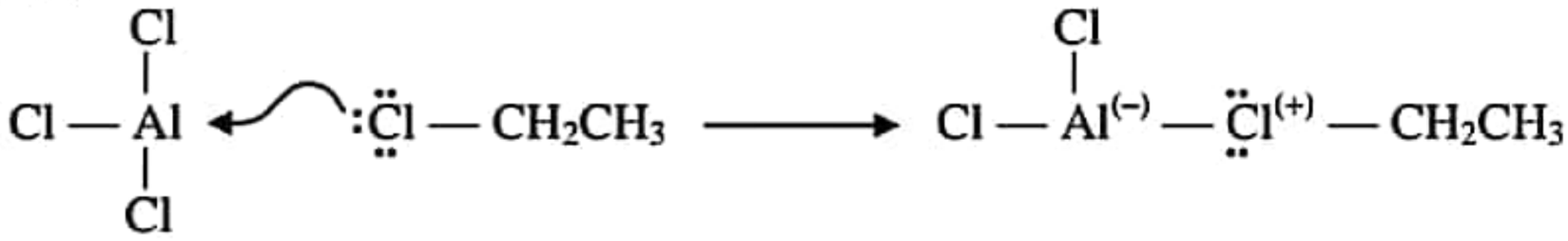
(1) 965 s (2) 1930 s (3) 2895 s (4) 9650 s (5) 28950 s

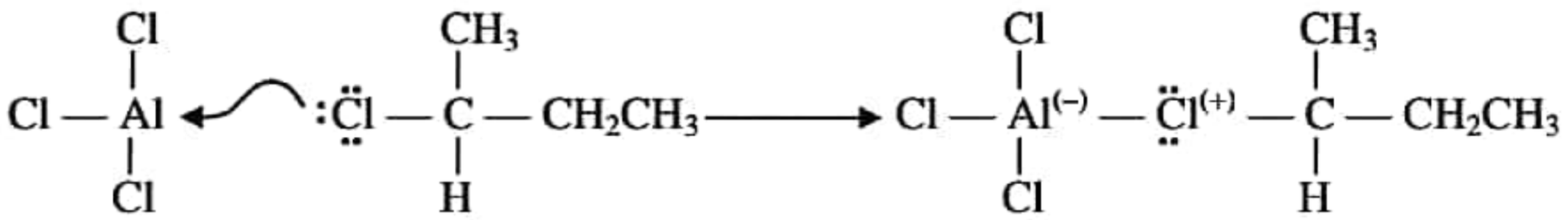
21. Complex ion which gives an aqueous solution with a differen colour is,

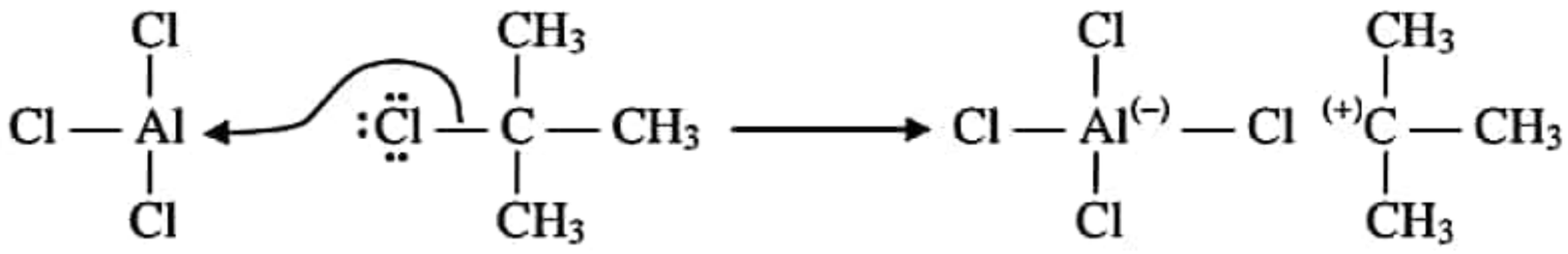
(1) $[Co(H_2O)_6]^{2+}$ (3) $[CoCl_4]^{2-}$ (5) $[Cu(NH_3)_4]^{2+}$

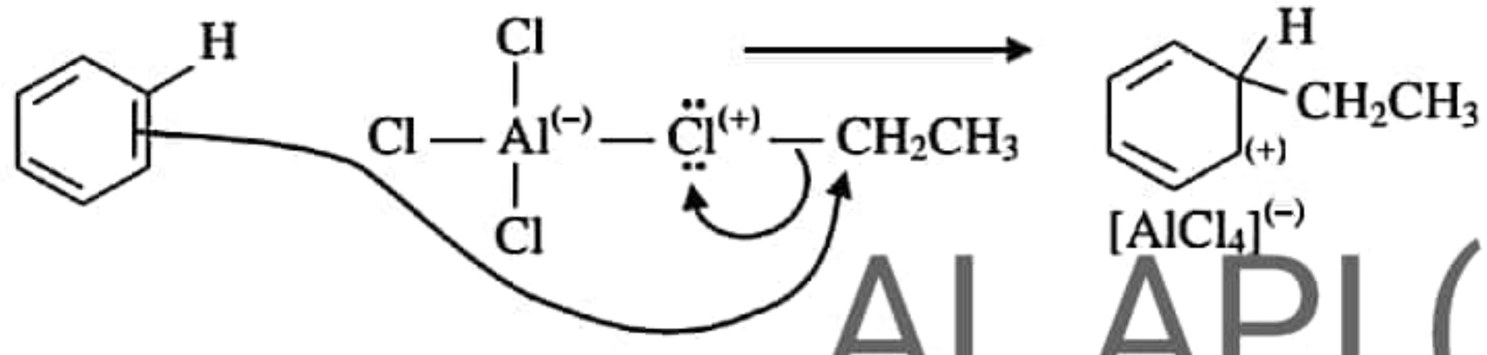
(2) $[Ni(NH_3)_6]^{2+}$ (4) $[Co(OH)_4]^{2-}$

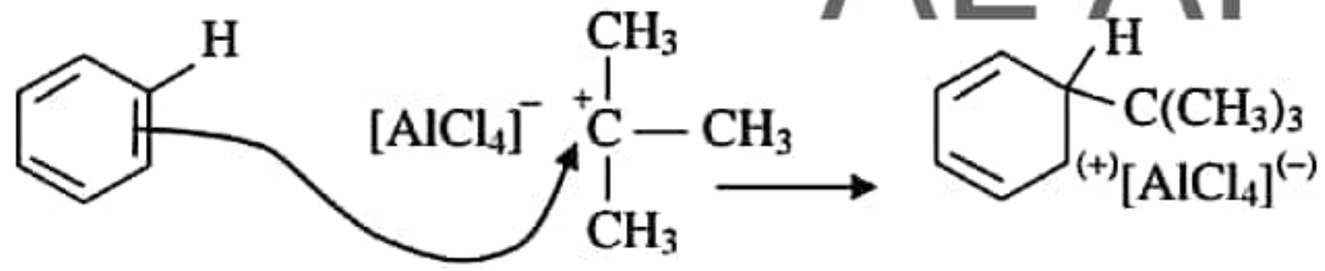
22. Which of the following mechanism step is not found in friedel crafts alkylation reaction of benzene?

(1) 

(2) 

(3) 

(4) 

(5) 

23. The standard enthalpy change of lattice dissociation of the ionic solid $MX_{(S)}$ is +778 $kJmol^{-1}$. The standard enthalpy changes of hydration of M^+ and X^- ions are – 406 $kJmol^{-1}$ and – 364 $kJmol^{-1}$ respectively. What is the standard enthalpy change of dissolution of $MX_{(S)}$?

(1) – 8 $kJmol^{-1}$ (3) – 112 $kJmol^{-1}$ (5) + 232 $kJmol^{-1}$

(2) + 8 $kJmol^{-1}$ (4) – 232 $kJmol^{-1}$

24. Consider the following elementary reaction.

$$A_{(g)} + B_{(g)} \longrightarrow C_{(g)} + 2D_{(g)}$$

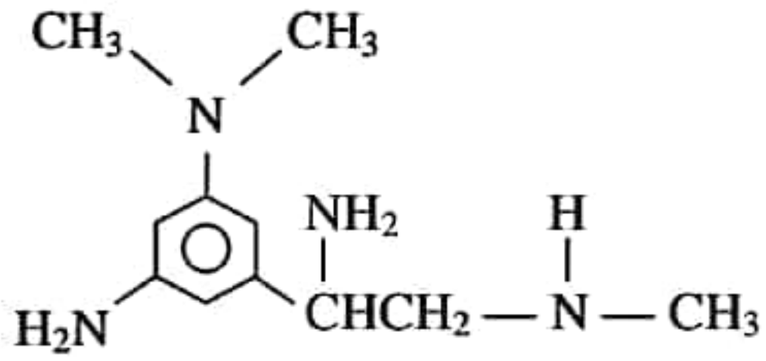
The initial rate was 'R_1' and pressure was 'P_1' when the reaction was initiated by adding equal moles of A and B in a closed rigid container, maintaining the temperature constant. The rate was 'R_2' and the pressure was 'P_2' at the time 't' seconds.

Which of the following gives the ratio $\frac{R_2}{R_1}$?

(1) $\left(\frac{2P_2}{P_1} - 3\right)^2$ (3) $\left(2 - \frac{3P_1}{P_2}\right)^2$ (5) $\left(3 - \frac{2P_2}{P_1}\right)^2$

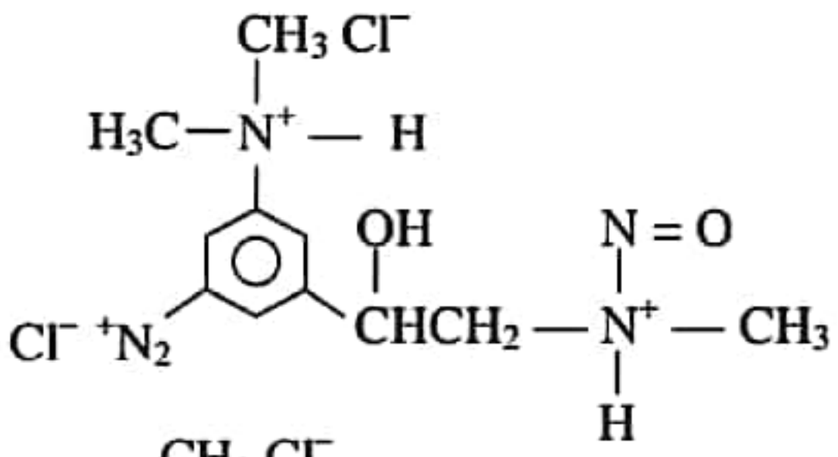
(2) $\left(\frac{2P_1}{P_2} - 3\right)^2$ (4) $\left(3 - \frac{2P_1}{P_2}\right)^2$

25. Which of the following could most possibly be the product of the reaction below?

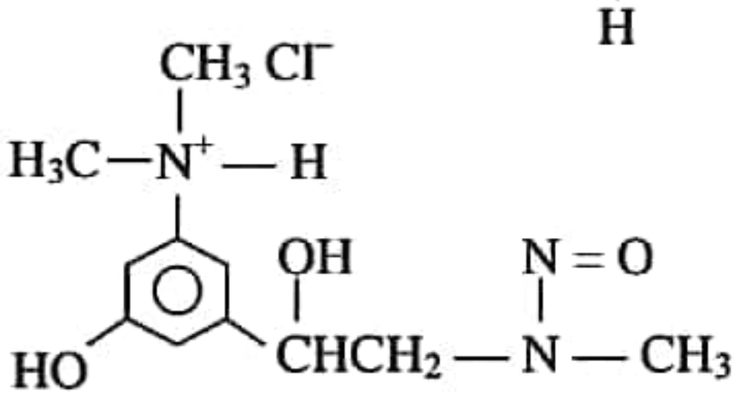


$$\xrightarrow[\text{NaNO}_{2(aq)}\ 0-5^{\circ}\text{C}]{\text{dilute HCl}} \ ?$$

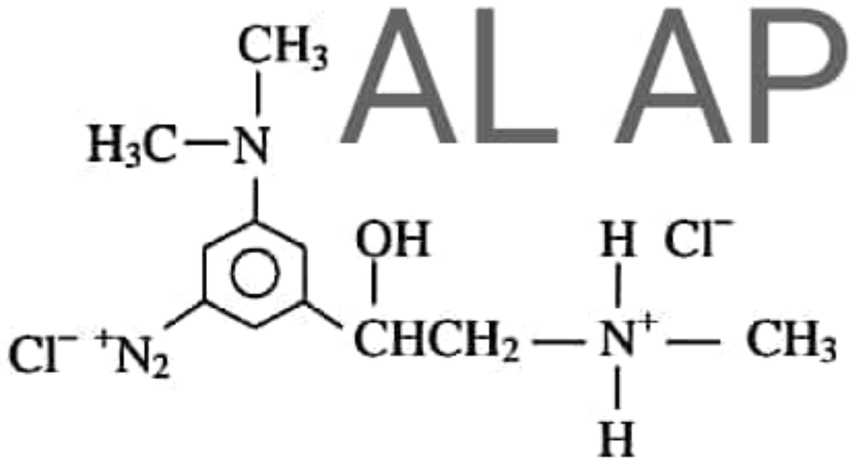
(1)



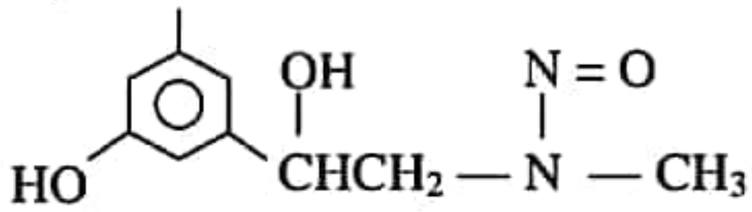
(2)



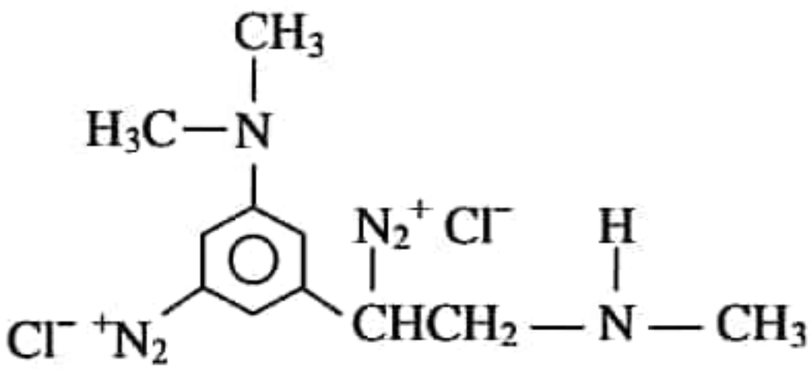
(3)



(4)



(5)



26. A clear solution was formed when aqueous solution of the salt X was treated with excess NaOH. A white coloured precipitate and a brown gas were given when the formed clear solution was treated with slight amount of dilute HCl X could be,

(1) $Pb(NO_3)_2$ (2) $Zn\ Br_2$ (3) $Zn(NO_3)_2$ (4) $Cu(NO_2)_2$ (5) $Al(NO_2)_3$

27. A H_2SO_4 solution having its mass percentage ($^{W}/_{W}$ %) 30% was planned to be prepared by mixing solution A having 62% of H_2SO_4 with solution B having 18% of H_2SO_4. What is the mass ratio (A : B) of these two solution required to be mixed to prepare the solution?

(1) 3 : 8 (2) 8 : 3 (3) 9 : 16 (4) 16 : 9 (5) 19 : 41

28. Ammonia forms the complex ion $[Cu(NH_3)_4]^{2+}$ with copper ions in alkaline solutions but not in acidic solutions. The possible reason for this could be,

(1) Copper hydroxide is an amphoteric substance

(2) In acidic solutions copper ions are protected by being hydrated.

(3) In acidic solutions protons coordinate with ammonia molecules forming NH_4^+ ions and therefore NH_3 molecules are not available.

(4) In alkaline solutions, water insoluble $Cu(OH)_2$ is precipitated which is soluble in any excess alkali.

(5) Anion given by the acid is a stronger ligand than NH_3.

29. The false statement regarding to the polymers is,

(1) When monomers have more than two reactive sites three dimensional network polymers are formed.

(2) Thermoplastics are composed of linear polymer molecules or branched polymer molecules while thermo set polymers are composed of three dimensional networks.

(3) The natural polymer, indentifies as trans – polyisoprene does not show elastic properties.

(4) When PVC goods are exposed to ultraviolet rays, removal of HCl molecules is taken place.

(5) Natural rubber is heated with 35 – 40% of sulphar by mass to improve the elastic property of rubber as required industrially and strengthen it.

30. When 20.0 cm^3 of 0.20 $moldm^{-3}$ $Na_2S_2O_8$ solution was added to a solution having excess $KI_{(aq)}$ following reaction was taken place.

$$S_2O_8^{2-} + 2I^- \longrightarrow I_2 + 2SO_4^{2-}$$

What is the minimum volume of 0.50 $moldm^{-3}$ $Na_2S_2O_3$ that requires to react completely with I_2 formed in this reaction?

(1) 12.0 cm^3 (3) 20.0 cm^3 (5) 30.0 cm^3

(2) 16.0 cm^3 (4) 24.0 cm^3

❖ The instructions for the questions from **31** to **40** are given below.

Mark

(1) If only (a) and (b) are correct

(2) If only (b) and (c) are correct

(3) If only (c) and (d) are correct

(4) If only (d) and (a) are correct

(5) If any other number or combination of responses is / are correct.

Summary of above instructions				
(1)	**(2)**	**(3)**	**(4)**	**(5)**
Only (a) and (b) are correct	Only (b) and (c) are correct	Only (c) and (d) are correct	Only (d) and (a) are correct	Any other response or combination of responses is correct.

31. $2NO_{2(g)} \longrightarrow 2NO_{(g)} + O_{2(g)}$; $\Delta H^{\theta} = +x$ $kJmol^{-1}$

The reaction above is endothermic and not spontaneous at 25°C. Which of the following statement/s is/are true regarding this reaction?

(a) This reaction could be spontaneous at low temperatures.

(b) This reaction is not spontaneous at all the temperatures.

(c) This reaction could be spontaneous at high temperatures.

(d) The backward reaction of the above could be spontaneous at low temperatures.

32. The false statement/s is/are,

(a) When H_2O_2 is gradually added to an alkaline $Cr(NO_3)_3$ solution, its colour changes to yellow.

(b) It can not be distinguished between two gases SO_2 and H_2S by using an acidic $K_2Cr_2O_7$ solution.

(c) The hydroxides $Zn(OH)_2$ and $Al(OH)_3$ dissolve in excess NaOH as well as in excess ammonia.

(d) The reaction between $CuSO_4$ and KI changes the colour of the solution from blue to brown.

33.

The true statement regarding this compound is/are,

(a) This compound reacts with aqueous NaOH.

(b) $-NO_2$ group is attached to the meta position of the benzene ring when this compound is nitrated.

(c) $C_6H_5NHCH_2CH_3$ is formed when this compound is reduced using $NaBH_4$.

(d) $-NO_2$ group is attached to otho or para positions of the benzene ring when this compound is nitrated.

34. Following reaction exists at dynamic equilibrium at a given temperature.

$$A_{(g)} + 3B_{(g)} \rightleftharpoons 2C_{(g)} \; ; \; \Delta H = -x \; kJmol^{-1}$$

Which of the following makes the equilibrium point shifts right?

(a) Increase of temperature of the system.

(b) Removal of $C_{(g)}$ from the system.

(c) Addition of $A_{(g)}$ to the system.

(d) Addition of an innert gas maintaining the volume constant.

35. The true statement/s regarding to the s and p block elements is/are?

(a) The water solubility of sulphates increases and hydroxides decreases down the second group.

(b) The oxidizing property of halogens decreases down the group.

(c) Basicity of the hydroxides of the 1^{st} group elements increases down the group.

(d) F_2O is a neutral oxide and the oxidation number of F is +1.

36. The true statement/s regarding to the distillations of substances is/are,

(a) Fractional distillation is a separation process of a substance based on its solubility in a solvent.

(b) Liquids with low boiling points are separated at upper chambers of a separation tower.

(c) The mixture boils at a lower temperature than the boiling point of pure substance in steam distillation.

(d) Efficiency of a fractional distillation tower increases with decrease of its height.

37. 20 cm^3 of a solution having NaOH and Na_2CO_3 was titrated with 0.1 $moldm^{-3}$ HCl solution. The volume of HCl used was 20 cm^3 when methyl orange was used as the indicator and it was 15 cm^3 when phenolphthalein was used as the indicator. Which of the following statement/s is/are true regarding this titration?

(a) The concentration of NaOH in the solution is 0.05 $moldm^{-3}$ and Na_2CO_3 is 0.05 $moldm^{-3}$.

(b) The equivalence point pH doesn't change based on indicator, though it is phenolphthalein or methyl orange.

(c) When methyl orange is used as the indicator end point colour change is yellow → red.

(d) The concentration of NaOH in the solution is 0.05 $moldm^{-3}$ and Na_2CO_3 is 0.025 $moldm^{-3}$.

38. The true statement/s regarding to the 3d metals is/are,

(a) As the atoms having unpaired d electrons belong to the category transition elements, the 3d metals except Cu and Zn are transition metals.

(b) As the elements which from cations with unpaired d electrons belong to the category transition elements, the 3d metals except Sc and Zn are transition metals.

(c) As the elements or their cations having unpaired d electrons are transition metals, other 3d elements except Zn are transition elements.

(d) Zn doesn't form complex ions as it is not a transition metal.

39. $H_3PO_{4(aq)} \rightleftharpoons H^+_{(aq)} + H_2PO_4^-{}_{(aq)}$; Ka_1

$H_2PO_4^-{}_{(aq)} \rightleftharpoons H^+_{(aq)} + HPO_4^{2-}{}_{(aq)}$; Ka_2

$HPO_4^{2-}{}_{(aq)} \rightleftharpoons H^+_{(aq)} + PO_4^{3-}{}_{(aq)}$; Ka_3

False response/s is/are,

(a) $Ka_1 > Ka_2 > Ka_3$

(b) Both $H_3PO_{4(aq)}$ and $H_2PO_4^-{}_{(aq)}$ are more acidic than $HPO_4^{2-}{}_{(aq)}$.

(c) pH of $(H_2PO_4^-{}_{(aq)}) = \frac{pKa_1 + pKa_2}{2}$

(d) Only $HPO_4^{2-}{}_{(aq)}$ is the amphoprotic anion in the solution.

40. Consider the following two electrodes

$E^\theta_{KCl(sat.)} \,|\, Hg_2Cl_{2(s)} \,|\, Hg_{(l)} = 0.24$ V $E^\theta_{Pt(s)} \,|\, Fe^{3+}_{(aq)} \,|\, Fe^{2+}_{(aq)} = 0.77$ V

The true statement/s regarding these is/are,

(a) As the concentration of $Hg_2Cl_{2(s)}$ is not changed with the time it is used as a standard reference electrode.

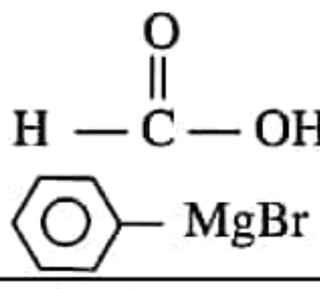
(b) $Fe^{3+}_{(aq)} \,|\, Fe^{2+}_{(aq)}$ electrode is used as a standard reference electrode due to the initial concentrations of both $Fe^{3+}_{(aq)}$ and $Fe^{2+}_{(aq)}$ are kept at the same standard value, 1.00 $moldm^{-3}$.

(c) The standard electromotive force of the cell prepared by using these two electrodes is 1.01 V.

(d) $Hg_2Cl_{2(s)} \,|\, Hg_{(l)}$ is the anode of the cell, prepared by connecting these two electrodes.

❖ In question numbers **41 – 50**, two statements are given in respect of each question. from the table given below, Select the response, out of the responses **(1), (2), (3), (4)** and **(5)** that best fit the two statements and mark appropriately on your answer sheet.

response	First statement	Second statement
(1)	True	True and correctly explains the first statement
(2)	True	True, but does not explain the first statement correctly
(3)	True	False
(4)	False	True
(5)	False	False

	First statement	Second statement
41.	The standard enthalpy change of neutralization of HF is smaller than the standard enthalpy change of neutralization of CH_3COOH.	Both HF and CH_3COOH are weak acids.
42.	The concentration of H^+ ions becomes half when the volume of 1.0 $moldm^{-3}$ HCOOH solution is doubled by adding water.	The molar dissociation amount of weak acids increases with dilution.
43.	Aniline reacts with bromine water giving a white precipitate.	Liquid bromine is added nucleophillically across the double bonds of aniline.
44.	 react very easily with	Grignards reagents are added across the carbonyl groups of aldehydes and ketones.
45.	CO_2 is a green house gas that can absorb infra red radiation.	CO_2 can persist in air for long period of time.
46.	There are two unpaired electrons in the outermost shell of Ni.	The only stable cation formed by the d block element Ni is Ni^{2+}.
47.	Methanoic acid serves as a reducing agent.	Methanioc acid liberates CO gas reacting with conc. H_2SO_4.
48.	The solution given when ethanol is dissolved in water, turns blue litmus red.	Ethanol shows acidic properties very weakly.
49.	Rutile, coke and HCl are used as the initial raw materials in production of TiO_2.	TiO_2 is formed by the reaction of $TiCl_4$ which is given by rutile, with Oxygen gas.
50.	Catalytic convertors are used to remove NO gas and volatile hydrocarbons which mainly contribute to the photo chemical smog.	Catalytic convertors transform NO gas to N_2 and volatile hydrocarbons to CO_2 and H_2O.

* * *

Periodic Table

	1																2
1	H																He
	3	4											5	6	7	8	9	10
2	Li	Be											B	C	N	O	F	Ne
	11	12											13	14	15	16	17	18
3	Na	Mg											Al	Si	P	S	Cl	Ar
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
	55	56	La-	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
6	Cs	Ba	Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
	87	88	Ac-	104	105	106	107	108	109	110	111	112	113					
7	Fr	Ra	Lr	Rf	Db	Sg	Bh	Hs	Mt	Uun	Uuu	Uub	Uut	...				

57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

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