G.C.E (A/L) Examination
2009 August
Chemistry I / Two hours

Important

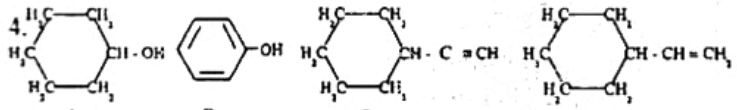
- *This paper consists of 08 pages (Periodic Table is also provided)*
- *Answer all the questions*
- *Use of calculators is not allowed.*
- *Write your Index Number in the space provided in the answer sheet.*
- *Instructions are given on the back of the answer sheet. Follow those carefully.*
- *In each of the questions 1 to 60, pick one of the alternatives, from (1), (2), (3), (4), (5) which is correct or most appropriate and mark your response on the answer sheet with a cross (x) on the number of the correct option in accordance with the instructions given on the back of the answer sheet.*

Universal gas constant $R = 8.314\ JK^{-1}\ mol^{-1}$
Avogadro Constant $N_A = 6.022 \times 10^{23}\ mol^{-1}$

1. The number of elements that exist as gases at room temperature is.
(1) 8 (2) 9 (3) 10 (4) 11 (5) 12

2. The electronic configuration of the element (X) that forms a diatomic molecule (X_2) with the highest bond energy is,
(1) $1s^2\ 2s^2 2p^6 3s^1$ (2) $1s^2 2s^2 2p^4$
(3) $1s^2 2s^2 2p^3$ (4) $1s^2 2s^2 2p^1$
(5) $1s^2 2s^2 2p^2$

3. Among the following, the molecules/ions having the same shape are,
(A) NH_3 (B) H_3O^+ (C) ClF_3
(D) BCl_3 (E) PCl_3
(1) A and C (2) C and D (3) A, B and E
(4) C. D and E (5) B and C

4. 

The correct increasing order of the acid strength of the compounds A,B,C and D is,
(1) A<C<B<D (2) D<C<A<B (3) B<D<C<A
(4) C<A<B<D (5) A<C<D<B

5. A solution of Na_2SO_4 has been prepared by dissolving 142 mg of pure Na_2SO_4 in water, in a 500 cm^3 volumetric flask and by diluting up to the mark. The Na^+ ion content in mg dm^{-3} units in this solution is, (O = 16.0, Na = 23.0, S = 32.0)
(1) 2.00×10^{-3} (2) 4.00×10^{-3} (3) 46
(4) 92 (5) 184

6. The decreasing order of the volume percentages of the gases (A) Ar, (B) CO_2, (C) H_2, (D) N_2 and (E) O_2 in air, in general is,
(1) D>E>B>A>C (2) D>E>A>B>C
(3) D>E>B>C>A (4) E>D>A>B>C
(5) D>A>E>B>C

7. Which of the following reacts most rapidly when mixed with $ZnCl_2$ and conc. HCl?
(1) $CH_2 = CH\overset{CH_3}{\underset{CH_3}{C}}OH$ (2) $CH_3CH_2\overset{CH_3}{C}HOH$
(3) $CH_3\overset{CH_3}{\underset{CH_3}{C}}OH$ (4) $CH_3CH_2CH_2CH_2OH$
(5) $CH_2 = CHCH_2CH_2OH$

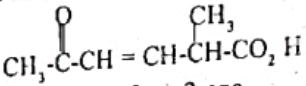
8. The mass percentage of $Na_2S_2O_3.5H_2O$ in an aqueous solution is 20%. The density of this solution at room temperature is 1.24 g cm^{-3}. The molarity of $Na_2S_2O_3$ is this solution is.
(H = 1.0, O = 16.0, Na = 23.0, S = 32.0)
(1) 1.0 (2) 1.0×10^{-3} (3) 0.050 (4) 1.6 (5) 0.10

9. Which of the following statements is not true regarding transition elements in general?
(1) They all are metals.
(2) They form complex cations.
(3) They do not form oxy-anions.
(4) They show variable oxidation states.
(5) They have catalytic properties.

10. Which of the following electronic configurations corresponds to the atom with the largest atomic radius among them?
(1) $1s^2 2s^2$ (2) $1s^2 2s^2 2p^6$
(3) $1s^2 2s^2 2p^6 3s^2$ (4) $1s^2 2s^2 2p^6 3s^2 3p^2$
(5) $1s^2 2s^2 2p^6 3s^2 3p^3$

11. In which of the following groups of molecules/ions, nitrogen is in the oxidation states -3, 0 and +3 respectively?
(1) NH_4^+, N_2, NH_2^- (2) N_2O_3, N_2, NH_4^+
(3) N_2H_4, N_2, NCl_3 (4) NO_2, N_2, NO_2^-
(5) NH_4^+, N_2, N_2O_3

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



(1) 5 - Carboxyhex -3-en-2-one
(2) 5-Oxohex-3-en-2-carboxylic acid
(3) 5-Methyl-2-oxohex-3- enoic acid
(4) 2-Methylhex-5-on-3-enoic acid
(5) 2-Methyl-5-oxohex -3-enoic acid

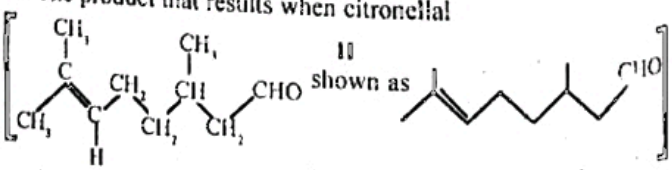
13. The correct increasing order of the first ionization energies of the elements from Li to F is.
(1) Li<B<Be<C<O<N<F (2) Li<Be<B<C<N<O<F
(3) Li<Be<B<C<O<N<F (4) Li<Be<B<O<C<N<F
(5) Li<B<Be<O<C<N<F

14. A sample of H-atoms excited in a flame has electrons distributed in n = 1,2, 3, 4 and 5 energy levels. How many different wavelengths of radiation are emitted by the sample according to Bohr theory?
(1) 4 (2) 5 (3) 8 (4) 10 (5) 15

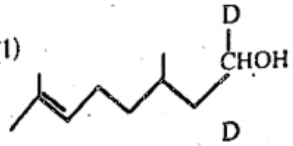
15. The relative molecular masses of X and Y are in the ratio 2:3. In a mixture of X and Y the mole fraction of X is 1/3. The mass percentage of X in the mixture is,
(1) 10% (2) 25% (3) 33.3% (4) 50% (5) 75%

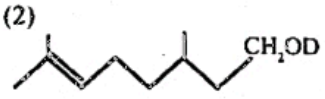
16. Which of the following statements is not true regarding H_2O_2?
(1) H_2O_2 disproportionates when heated.
(2) In acid medium, Fe^{2+} ions reduce H_2O_2 to H_2O.
(3) Ag_2O oxidizes H_2O_2 to O_2
(4) H_2O_2 is used as an antiseptic
(5) The dipole moment of H_2O_2 is zero.

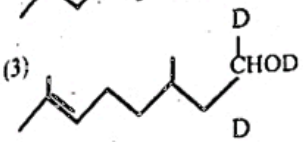
17. The product that results when citronellal

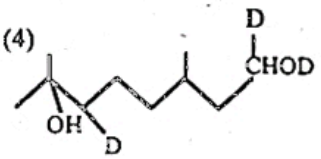


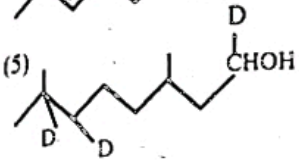
is treated with sodium borodeuteride ($NaBD_4$) followed by hydrolysis with water is

(1) 

(2) 

(3) 

(4) 

(5) 

18. When a salt X was heated with dil. H_2SO_4, it evolved a gas that gives a white precipitate with a lead acetate solution. When X was heated with dil. H_2SO_4 and Zn, it evolved a gas that gives a black precipitate with a lead acetate solution. The anion present in X is,
(1) S^{2-} (2) Cl^- (3) NO_3^- (4) CO_3^{2-} (5) SO_3^{2-}

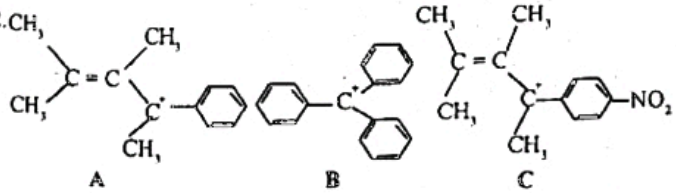
19. The correct decreasing order of the ionic radii of the ions Al^{3+}, F^-, Mg^{2+}, Na^+ and O^{2-} is,
(1) $Al^{3+} > F^- > Na^+ > Mg^{2+} > O^{2-}$ (2) $Al^{3+} > Mg^{2+} > O^{2-} > Na^+ > F^-$
(3) $O^{2-} > F^- > Na^+ > Mg^{2+} > Al^{3+}$ (4) $Al^{3+} > Mg^{2+} > Na^+ > F^- > O^{2-}$
(5) $F^- > O^{2-} > Na^+ > Al^{3+} > Mg^{2+}$

20. The amounts of heat evolved when 25.0cm³ each of the following aqueous solutions are mixed together are given below.

Solutions mixed	Heat evolved
0.1 mol dm^{-3} HCl and 0.1 mol dm^{-3} NaOH	ΔH_1
0.1 mol dm^{-3} HCl and 0.1 mol dm^{-3} NH_4OH	ΔH_2
0.1 mol dm^{-3} CH_3COOH and 0.1 mol dm^{-3} NH_4OH	ΔH_3
0.05 mol dm^{-3} H_2SO_4 and 0.05 mol dm^{-3} $Ba(OH)_2$	ΔH_4

Which of the following is correct?
(1) $\Delta H_1 > \Delta H_2 > \Delta H_3 > \Delta H_4$ (2) $\Delta H_4 = \Delta H_3 = \Delta H_2 = \Delta H_1$
(3) $\Delta H_1 = \Delta H_4 > \Delta H_3 > \Delta H_2$ (4) $\Delta H_1 = \Delta H_4 > \Delta H_2 > \Delta H_3$
(5) $\Delta H_4 > \Delta H_1 > \Delta H_2 > \Delta H_3$

21. Of the following scientists, identify who was not connected with the development of the atomic theory?
(1) Neils Bohr (2) J.J. Thomson (3) Chadwick
(4) Linus Pauling (5) Rutherford

22. 

A B C

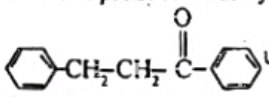
The correct increasing order of stability of the carbocations A, B and C is,
(1) A<B<C (2) C<A<B (3) B<C<A
(4) A<C<B (5) C<B<A

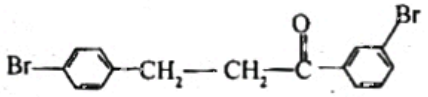
23. Which of the following is the strongest reducing agent in the gas phase?
(1) Al (2) Na (3) Zn (4) H_2 (5) F_2

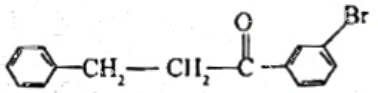
24. Which of the following gases will react with an aqueous solution of $FeBr_3$?
(A) SO_2 (B) CO_2 (C) H_2S (D) Cl_2
(1) A and B (2) A, B and C (3) A, C and D
(4) C and D (5) A, B and D

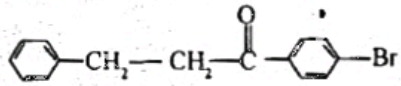
25. Which of the following statements is not true regarding electrolysis?
(1) Chemical energy is converted to electrical energy during electrolysis.
(2) The oxidation state of at least one element of a chemical species is changed in each electrode reaction.
(3) The pH of the solution is changed if H_2O is a reactant only in one of the electrode reactions.
(4) The amount of a substance produced during electrolysis depends on the electric current passed.
(5) Electrolysis is a convenient method to produce some metals in pure state.

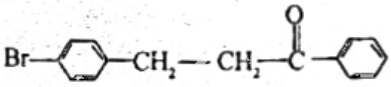
26. Which of the following will not evolve ammonia gas when heated with aqueous NaOH?
(1) Urea (2) $(NH_4)_2CO_3$ (3) $NaNO_3$ + Zn powder
(4) $[Cu(NH_3)_4]SO_4$ (5) $NaNO_3$+Fe powder

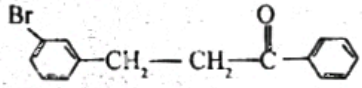
27. What product would you expect when the compound  undergoes bromination with Br_2 and $FeBr_3$?

(1) 

(2) 

(3) 

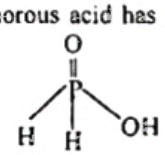
(4) 

(5) 

28. Which of the followings can be used separately to distinguish between aqueous solutions of Na_2CO_3 and $NaHCO_3$?
(A) Phenolphthalein (B) Methyl orange
(C) Litmas paper (D) Lime water
(1) A and B (2) A, B and C (3) B and C
(4) B and D (5) A and D

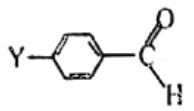
29. The equilibrium constant for the reaction;
$Al^{3+}(aq)+6F^-(aq) \rightleftharpoons AlF_6^{3-}(aq)$ at 25°C is 1.0×10^{25} $mol^{-6}dm^{18}$.
The concentration of $AlF_6^{3-}(aq)$ in mol dm^{-3} in the solution obtained when 25.0 cm^3 of 0.010 mol dm^{-3} $Al(NO_3)_3$ and 25.0 cm^3 of 0.10 mol dm^{-3} NaF are mixed with each other is,
(1) 0.010 (2) 0.0050 (3) 0.017
(4) 0.0084 (5) 0.060

30. Hypophosphorous acid has the structure



Which of the following properties are consistent with the above structure?
(A) It is a reducing agent.
(B) It is a monobasic acid.
(C) Phosphorus atom is in -1 oxidation state.
(D) Phosphorus atom is in +1 oxidation state.
(1) A only (2) B only (3) A and B only
(4) A, B and D only (5) A, B and C only

31 The rates of the reaction of benzaldehyde compounds,



(where Y = NO_2, Cl, CH_3 or OH) with hydrogen cyanide, under identical conditions follow the order,

(1) O_2N-C_6H_4-CHO<Cl-C_6H_4-CHO<CH_3-C_6H_4-CHO<HO-C_6H_4-CHO

(2) HO-C_6H_4-CHO<CH_3-C_6H_4-CHO<Cl-C_6H_4-CHO <O_2N-C_6H_4-CHO

(3) Cl-C_6H_4-CHO<CH_3-C_6H_4-CHO<HO-C_6H_4-CHO<O_2N-C_6H_4-CHO

(4) CH_3-C_6H_4-CHO<Cl-C_6H_4-CHO<O_2N-C_6H_4-CHO<HO-C_6H_4-CHO

(5) O_2N-C_6H_4-CHO<HO-C_6H_4-CHO<$CH_3C_6H_4$-CHO<Cl-C_6H_4-CHO

32. Which one of the following statements is not true about the hydrogen halides HF, HCl, HBr and HI?

(1) HF has the highest boiling point.

(2) HI has the lowest bond energy.

(3) HI is the strongest acid in aqueous solution.

(4) HF is the most covalent.

(5) HCl has the lowest boiling point.

33. $Zn(s)/Zn^{2+}$ (aq. 1.0 mol dm^{-3}) and $Cu(s)/Cu^{2+}$ (aq. 1.0 mol dm^{-3}) electrodes were combined through a salt bridge to construct an electrochemical cell. The standard reduction electrode potentials of the Zn^{2+} (aq)/Zn(s) and Cu^{2+}(aq)/Cu(s) electrodes at 25°C are - 0.76 V and +0.34 V, respectively. The experimentally measured e.m.f. of the above cell at the same temperature was 1.20 V. Which of the following statements would not be a possible reason for the deviation of the measured e.m.f. as compared to the expected value?

(1) The concentrations of solutions were slightly different from 1.0 mol dm^{-3}.

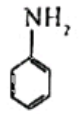
(2) The temperature of measurement was different from 25°C.

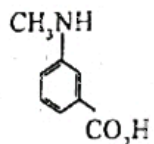
(3) The Cu rod used to construct the Cu electrode had been corroded.

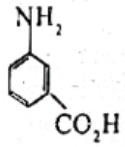
(4) The Zn rod and the Cu rod were immersed in Cu^{2+} and Zn^{2+} solutions, respectively.

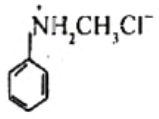
(5) The potentiometer used to measure the potential was not functioning properly.

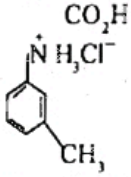
34. Compound A reacts with aqueous Na_2CO_3 releasing a gas that turns lime water milky. A is insoluble in aqueous NaOH. A gives a red dye when treated with nitrous acid followed by phenol in aqueous NaOH. What is the structure of A?

(1) 

(2) 

(3) 

(4) 

(5) 

35. A 50.0 cm^3 sample of 1.00 mol dm^{-3} HCl solution was mixed with a 100.0 cm^3 sample of 0.50 mol dm^{-3} NaOH solution in an insulated flask. Then the temperature of the solution mixture rose from 25.0°C to 29.5°C. If the specific heat of the solution mixture is 4.2 $J^{\circ}C^{-1}$ g^{-1} and the heat capacity of the flask is negligible, the enthalpy of neutralization of HCl and NaOH, in $KJmol^{-1}$ at this temperatue is,

(1) 1.1 (2) 57000 (3) 57 (4) 570 (5) 2.8

36. The structure of nylon 6,6 is,

(1) $+CO\text{-}(CH_2)_6\text{-}CONH(CH_2)_4NH+_n$

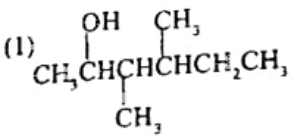
(2) $+CO\text{-}(CH_2)_4CONH(CH_2)_4NH+_n$

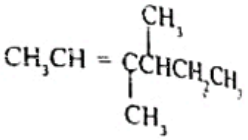
(3) $+CO(CH_2)_6NH+_n$

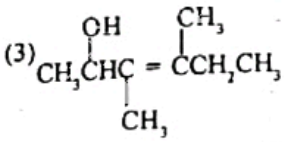
(4) $-[CO-(CH_2)_6CO-NH(CH_2)_6NH]_n$

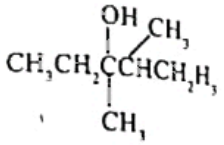
(5) $-[CO(CH_2)_4CONH(CH_2)_6NH]_n$

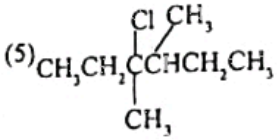
37. 2-Butanol reacts with acidified sodium dichromate to give A. Another sample of 2-butanol reacts with PCl_3 to give B. When heated with magnesium and ether, B gives C. A and C react to give a product which hydrolysis produces D. What is the structure on of D?

(1) 

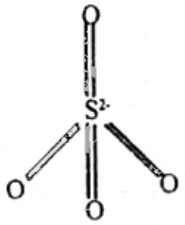
(2) 

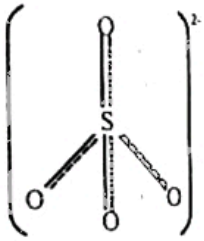
(3) 

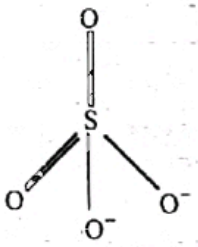
(4) 

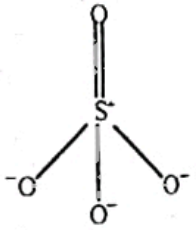
(5) 

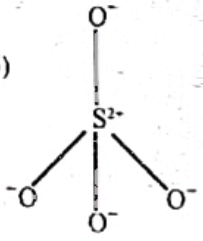
38. The structure which is closest to the true structure of the sulphate ion is

(1) 

(2) 

(3) 

(4) 

(5) 

39. In which of the following solvents would hexane have the lowest solubility?
(1) Dichloromethane
(2) Diethyl ethre
(3) Ethanol
(4) Ethyl acetate
(5) Porpanone

40. What would happen to the concentration of Fe^{3+} in a saturated solution of $Fe(OH)_3$ when the pH of the solution is increased by one unit?
(1) Decrease by 1000 times
(2) Decrease by 10 times
(3) Increase by 1000 times
(4) Increase by 10 times
(5) Remain unchanged.

Instructions for questions No. 41 to 50 :

For each of the questions 41 to 50, four responses *(a)*, *(b)*, *(c)* and *(d)* are given; out of which, one or more is/ are correct. Select the correct response/responses. In accordance with the instructions given on your answer sheet, 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 correct.

Summary of above Instructions

(1)	(2)	(3)	(4)	(5)
Only *(a)* and *(b)* correct.	Only *(b)* and *(c)* correct.	Only *(c)* and *(d)* correct.	Only *(d)* and *(a)* correct.	Any other number or combination of responses correct.

41. Which of the following statements regarding water is/are true?
(a) Water reacts more readily with ethanoyl chloride than with chloroethane.
(b) Water reacts readily with CH_3MgBr to produce methanol.
(c) The dipole moment of a water molecule is zero.
(d) In ice, four hydrogen atoms are arranged tetrahedrally around each oxygen atom.

42. Which of the following substance(s) would produce acidic solutions when dissolved in water?
(a) NH_4Cl *(b)* NH_4ClO_3 *(c)* CH_3COONa *(d)* NaF

43. A and B are two miscible liquids. The boiling point of A is higher than that of B. An equimolar solution of A and B is placed in an evacuated vessel and allowed to reach equilibrium with its vapour. Which of the following is/are true regarding this system? (Assume ideal behaviour.)
At equilibrium,
X_A = mole fraction of A in solution phase.
X_B = mole fraction of B in solution phase.
Y_A = mole fraction of A in vapour phase.
Y_B = mole fraction of B in vapour phase.

(a) $X_A = X_B$ *(b)* $X_A + X_B = Y_A + Y_B$ *(c)* $X_A < X_B$
(d) $Y_A < Y_B$

44. Which of the following statements is/are not true regarding graphite?
(a) All the carbon atoms in graphite are sp^3 hybridized.
(b) It has a high melting point.
(c) It is a conductor of electricity.
(d) It is used as a fuel in industry.

45. Which of the following statements is/are true about steam distillation?
(a) Steam distillation is used to obtain ethanol after fermentation of sugar.
(b) Steam distillation of cloves gives an essential oil that contains eugenol as the major constituent.
(c) The composition of the distillate remains the same during steam distillation of cinnamon leaves.
(d) Steam distillation is used in refining petroleum.

46. Which of the following statements is/are true about metals?
(a) They conduct electricity.
(b) The density of all metals is higher than that of water.
(c) They react with dilute acids always liberating H_2 gas
(d) Majority of the elements are metals.

	First Statement	Second Statement
51	HF is a weaker acid than HCl in aqueous solution.	Fluorine is more electronegative than chlorine.
52	Addition of a few drops of H_2SO_4 increases the electrical conductance of water.	H_2SO_4 acid increases the dissociation of water molecules.
53	Polyvinyl chloride is an unsaturated polymer.	Polyvinyl chloride is made by the polymerization of CH_2=CH-Cl.
54	In nucleophilic addition reactions, aliphatic aldehydes are generally more reactive than aliphatic ketones.	The electron release from the alkyl groups in a ketone makes the carbonyl carbon less positively charged.
55	An oxidation reaction and a reduction reaction always occur simultaneously.	All chemical reactions are disproportionation reactions.
56	The change in $[H^+]$ when the pH of a solution is changed from 1 to 2 is the same as when the pH is changed from 3 to 4.	In aqueous solution, $pH = -\log_{10}[H^+]$
57	$C_6H_5CH_2NH_2$ and $C_6H_5NH_2$ are soluble in aqueous HCl, but $C_6H_5CONH_2$ is insoluble in aqueous HCl.	Base strength of $C_6H_5CONH_2$ is higher than that of either $C_6H_5CH_2NH_2$ or $C_6H_5NH_2$.
58	A wet litmus paper cannot be used to distinguish between CO_2 and SO_2.	Both CO_2 and SO_2 are acidic gases.
59	Real gases deviate more from ideal behaviour at high pressures and low temperatures.	A real gas molecule has a smaller volume than an ideal gas molecule.
60	The ionic product of water, K_w, decreases as the temperature is increased.	Dissociation of water is an exothermic process.