

QB365
Model Question Paper 3
11th Standard CBSE

Chemistry

Reg.No. :

--	--	--	--	--	--

Time : 02:00:00 Hrs

Total Marks : 100

Section-A

- 1) What is inert pair effect? 1
- 2) Why does AlCl_3 exist as dimer? 1
- 3) What is the formula of kernite, an ore of boron? 1
- 4) Is boric acid a protic acid? Explain 1
- 5) Boron is unable to form BF_6^{3-} ion. Explain 1
- 6) Select the members of group 14 that 1
is commonly found in +2 oxidation state
- 7) Which allotrope of carbon is used as moderator in atomic reactors? 1
- 8) What is the general valence shell electronic configuration of group 14 elements? 1
- 9) What are the basic units of the larger structure of orthoboric acid? How are they bonded? 1
- 10) Calculate the number of sigma bonds in 4 - methyl phenol. 1
- 11) How many σ and π bonds are present in each of the following molecules? 1
(i) $\text{H} \equiv \text{CCH} = \text{CHCH}_3$
- 12) What conclusion would you draw if the Lassaigne's extract gives a blood red colour with FeCl_3 ? Write the 1
relevant chemical equations.
- 13) Indicate the number of σ and π bonds in HCONHCH_3 . 1
- 14) In how many ways the cleavage of a covalent bond can take place? 1
- 15) Which of the following exhibit geometrical isomerism? 1
2, 3-dibromo-but-2-ene
- 16) What should be the tolerable limit of fluoride ions in drinking water? What happens if it is higher than 10 1
ppm?
- 17) Why does water covered with excessive algae growth become polluted? 1
- 18) What is siltation? 1
- 19) Which main compounds are causing damage to the ozone layer? 1
- 20) Ozone is a gas heavier than air. Why does ozone not settle down near the earth? 1

Section-B

- 21) Discuss the pattern of variation in the oxidation states of B to Tl 2
- 22) How does electron deficient compound BF_3 achieve electronic saturation, i.e fully occupied outer electron 2
shells?

- 23) Starting from SiCl_4 , prepare the following in steps not exceeding the number given in paranthesis (give reactions only) 2
silicon
- 24) Identify the most stable species in the following set of ions giving reasons 2
 CH_3^- , CH_2Cl^- , CHCl_2^- , CCl_3^-
- 25) Why is nitric acid added to sodim extract before adding silver nitrate for testing halogens? 2
- 26) What is a solution of potassium hydroxide used to absorb carbon dioxide evolved during the estimation of carbon present in an organic compound? 2
- 27) On converting benzene to toluene, state whether there will be a rise or fall in the melting point. 2
- 28) Why do you alkenes prefer to undergo electrophilic addition reaction while arenes prefer electrophilic substitution reactions? Explain 2
- 29) For dry cleaning in the place of tetrachloroethene, liquefied carbon dioxide with suitable detergent is an alternative solvent. What type of harm to the environment will be prevented by stopping use of tetrachloroethene? Will use of liquefied carbon dioxide with detergent be completely safe from the point of view of pollution. Explain. 2
- 30) Explain the following. 2
Gallium has higher ionisation enthalpy than aluminium.
- 31) Explain the Aluminium utensils should not be kept in water overnight 2
- 32) A certain salt X, gives the results 2
Borax swells up to a glassy mass on strong heating.
Its aqueous solution alkaline to litmus.
- 33) Three pairs of compounds are given below, Identify that compound in each of the pairs which has group 13 element in more stable oxidation state. Give reason for your choice. State the nature of bonding also. 2
 AlCl_3 , AlCl
- 34) Identify the compounds A, X and Z in the following reactions, 2

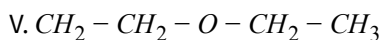
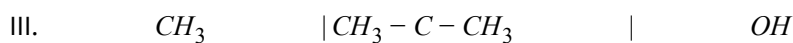
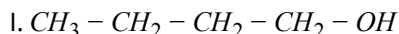
$$\underset{370K}{A} + 2\text{HCl} + 5\text{H}_2\text{O} \xrightarrow{>370K} 2\text{NaCl} + X$$

$$X \xrightarrow{\Delta} \text{HBO}_2 \xrightarrow{\Delta} Z$$
- 35) Identify the compounds A, X and Z in the following reactions, 2

$$Z + 3\text{LiAlH}_4 \rightarrow X + 3\text{LiF} + 3\text{AlF}_3 + 6\text{H}_2\text{O} \rightarrow Y + 6\text{H}_2\text{X} + 3\text{O}_2 \xrightarrow{\Delta} \text{B}_2\text{O}_3 + 3\text{H}_2\text{O}$$
- 36) Write structural formula for all the isomeric amines with molecular formula $\text{C}_4\text{H}_{11}\text{N}$. 2

37) Consider structure I to VII and answer the following questions (i) and (ii).

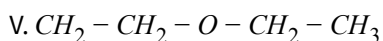
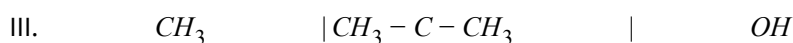
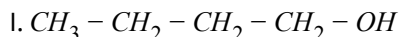
2



Identify the pairs of compound which are functional group isomers.

38) Consider structure I to VII and answer the following questions (i) and (ii).

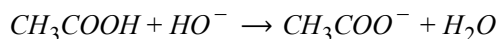
2



Identify the pairs of compounds that represent chain isomerism.

39) Identify the reagents shown in bold in the following equations as nucleophiles or electrophiles.

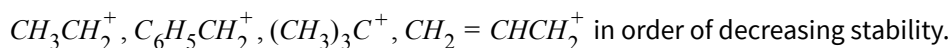
2



Electrophiles are electron deficient species, i.e. carry positive charge and nucleophiles are electron rich species i.e. carry negative charge.

40) Arrange the following

2



Section-C

41) A sample of 0.50 g of an organic compound was treated according to Kjeldahl's method. The ammonia evolved was absorbed in 50 mL of 0.5 M H_2SO_4 . The residual acid required 60 mL 0.5 M solution of NaOH for neutralisation. Find the percentage composition of nitrogen in the compound.

5

Calculate the volume of the H_2SO_4 used to neutralise NaOH. Calculate percentage of nitrogen by using the formula

$$N\% = \frac{1.4 \times NV}{w}$$

42) Sonu and Nilesh were friends. In winters, one day when they were going to school at 10:00 am Sonu felt irritation in his eyes and throat. He was also unable to breath.

5

Nilesh immediately took him to a doctor. Doctor gave him the proper remedy. When he became well, Nilesh asked reason for this Doctor answered him satisfactorily.

(i) Can you guess what reason was given by the doctor for the illness of Sonu.

(ii) Why such kind of polluting atmospheric change occurs?

(iii) What should be done to prevent the formation of smog?

(iv) What values are possessed by Nilesh?

- 43) Among group 14 elements name the elements having tendency to form $p\pi - p\pi$ bonds. 5
- 44) Aluminium dissolves in mineral acids and aqueous alkalis and thus shows amphoteric character. A piece of aluminum foil is treated with dilute hydrochloric acid or dilute sodium hydroxide solution in a test tube and on bringing a burning matchstick near the mouth of the test tube, a pop sound indicates the evolution of hydrogen gas. The same activity when performed with concentrated nitric acid, reaction doesn't proceed, Explain the reason 5
- 45) Mr. Sing altered the amount of cheque and was caught by police. Chromatography is an important technique extensively used to separate a mixture into their components to purify compounds and also to test the purity of compounds. If any cheque is written in a particular ink and somebody else alters it with another ink, it can be detected with the help of chromatography. How can forgery be detected with the help of chromatography? 5
- 46) Complete the following reactions 5
- $$CO + H_2 \xrightarrow[200 \text{ atm, } 675K]{ZnO, Cr_2O_3} \quad \rightarrow$$
- 47) Arrange the following set of compounds in order of their decreasing relative reactivity with an electrophile, E^+ . 5
- (i) Chlorobenzene, 2, 4-dinitrochlorobenzene, p-nitrochlorobenzene
- (ii) Toluene, $p - H_3C - C_6H_4 - NO_2$, $p - O_2N - C_6H_4 - NO_2$
- Also explain ur answer.
- 48) How can you apply green chemistry for the following? (i) To control photochemical smog 5
- (ii) To avoid use of halogenated solvents in dry
- (iii) To reduce use of synthetic detergents
- (iv) To reduce the consumption of petrol and diesel

Section-A

- 1) 1
- In the elements of 4th, 5th and 6th period of the p-block the electrons present in the intervening d and f-orbitals do not shield the s-electrons of the valence shell effectively. As a result, ns^{-2} -electrons remain more tightly held by the nucleus and hence, do not participate in bonding, this is called **inert pair effect**.
- 2) 1
- 3) Formula of kernite, $Na_2[B_4O_5(OH)_4]$ or $Na_2B_4O_7 \cdot 2H_2O$ 1
- 4) 1
- It is not a protic acid because it does not ionise in H_2O to give a proton. It acts as a Lewis acid by accepting electrons from a hydroxyl ion of water and in turn releases H^+ ions.
- $$B(OH)_3 + HOH \rightarrow [B(OH)_4]^- + H^+$$

- 5) 1
 Due to non-availability of d-orbitals, boron is unable to expand its covalency beyond 4. Hence, it does not form BF_6^{3-} ion.
- 6) 1
- 7) Graphite 1
- 8) 1
- 9) 1
- 10) 1
- 11) 1
- 12) 1
- 13) 1
- 14) 1
- 15) 1
- 16) 1 ppm or 1 mg dm^{-3} . Higher concentration is harmful to bones and teeth. 1
- 17) 1
 Presence of excessive algal growth shows that water contains a lot of phosphate due to inflow of fertilisers, etc., from the surroundings. Hence, such a sample of water is polluted
- 18) Mixing of soil or rock particles into water is called siltation. 1
- 19) NO and freons 1
- 20) 1
 Ozone is thermodynamically unstable and decomposes back to molecular oxygen before reaching near the earth surface. Moreover, as negligible amount of UV-rays reach near the surface hence formation of ozone near the surface is rare

Section-B

- 21) 2

Element	B	Al	Ga	In	Tl
Oxidation state	+3	+3	+3,+1	+3,+1	+1

Boron and aluminium show an oxidation state of +3 only because they do not exhibit inert pair effect due to the absence of d or f-electrons. Elements from Ga to Tl show two oxidation states, i.e. +1 and +3. The tendency to show +1 oxidation state increases down the group due to the inability of ns^2 electrons of valence shell to participate in bonding which is called inert pair effect. Therefore Tl^+ is more stable than Tl^{3+}

22) 2

BF₃ achieve it by the following ways

- (i) Multiple bonding or $p\pi - p\pi$ back bonding e.g BF₃ in which a lone pair of electron present in 2p-orbits of one of the fluorine atoms may be transferred to the vacant p-orbital on the bottom atom.
- (ii) Formation of complexes in which electrons are received from a donor molecule, e.g $F_3B \leftarrow NH_3$. Boron compounds, thus behave as Lewis acids.

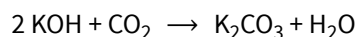
23) $3SiCl_4 + 4Al \rightarrow 4AlCl_3 + 3Si$ 2
Molten

24) 2
 $\bar{CCl}_3$ is the most stable species because on replacing H by Cl, negative charge on carbon is reduced and species is stabilized

25) sodium extract is boiled with nitric acid to decompose NaCN and Na₂S if present 2

26) 2

CO₂ is slightly acidic in nature therefore, it reacts with the strong base KOH to form K₂CO₃ and from the weight of the CO₂ obtained, the percentage of carbon in the organic compound is calculated.



The increase in the weight of U-tube containing KOH gives the weight of CO₂ produced and from the weight of the CO₂ obtained, percentage of carbon in the organic compound is calculated as

$$\% \text{ of carbon} = \frac{12}{44} \times \frac{\text{Weight of } CO_2 \text{ formed}}{\text{Weight of substance taken}} \times 100$$

27) 2

On converting benzene to toluene, there is a fall in the melting point although toluene has the higher molecular mass. This is because the planar molecules of benzene can pack more closely in the crystal lattice and the cohesive forces are strong, whereas the methyl group in toluene prevents such close packing.

28) 2

Alkenes are rich source of loosely held π electrons, due to which they show electrophilic addition reaction. Electrophilic addition reactions of alkenes are accompanied by large energy changes so these are energetically favourable than that of Electrophilic substitution reactions.

In special conditions alkenes also undergo free radical substitution reactions.

In arenes during electrophilic addition reactions aromatic character of benzene ring is destroyed while during electrophilic substitution reactions of arenes are energetically more favourable than that of electrophilic addition reaction.

That's why alkenes prefer to undergo electrophilic addition reaction while arenes prefer electrophilic substitution reactions.

29) 2

(i) Tetrachloroethene, Cl₂C=CCl₂ is suspected to be carcinogenic and also contaminates the ground water. This harmful effect will be prevented by using liquefied CO₂ along with suitable detergent

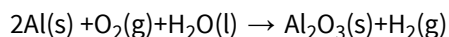
(ii) Use of liquefied CO₂ along with detergent will not be completely safe because most of the detergents are non-biodegradable and they cause water pollution. Moreover, liquefied CO₂ will ultimately enter into the atmosphere and contribute to the green house effect.

30)

In gallium due to poor shielding of valence electrons by the intervening 3d-electrons, the nuclear charge becomes effective, thus, atomic radius decreases and hence, the ionisation enthalpy of gallium is higher than that of aluminium.

31)

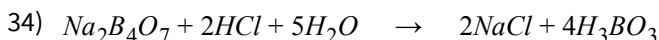
Because aluminium reacts with water and oxygen (dissolved in) to form a thin layer of toxic aluminium oxide on the surface of utensils.



32) Aqueous solution of salt X is alkaline. It indicates that X is the salt of a strong base and a weak acid.

33)

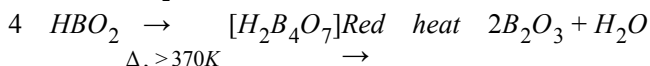
Due to absence of d-orbitals, Al does not show inert pair effect. Therefore, its most stable oxidation state is +3. Thus, AlCl_3 is much more stable than AlCl . Further, in the solid or the vapour state, AlCl_3 is covalent in nature but in aqueous solutions, it ionises to form $\text{Al}^{3+}(\text{aq})$ and $\text{Cl}^{-}(\text{aq})$ ions.



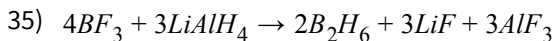
Borax(A) Orthoboric acid(X)



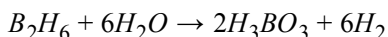
(X) Metaboric acid

$$-H_2O$$


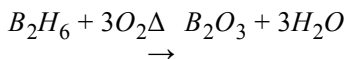
Tetraboric acid Boron trioxide



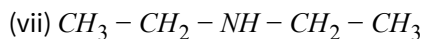
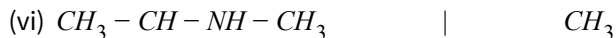
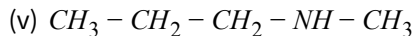
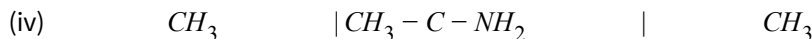
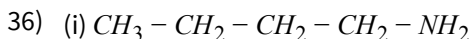
Boron trifluoride(Z) Diborane(X)



(X) Orthoboric acid(Y)



(X)



37)

I and V, I and VI, I and VII; II and V, II and VI, II and VII; III and V, II and VI; III and VI; III and VII; IV and V; IV and VI and IV and VII are functional group of isomers.

47)

5

Presence of electron releasing group(or activating group) increases the electron density in benzene nucleus. Therefore, electrophile will attack benzene nucleus easily. But, the presence of electron withdrawing group like $-\text{NO}_2$ decrease the electron density in benzene ring. Therefore, electrophile will attack benzene nucleus with difficulty. The order of reactivity towards electrophile, E^+ in order of their decreasing relative reactivity is

(i) Chlorobenzene > p-nitrochlorobenzene > 2, 4- dinitrochlorobenzene

(ii) Toluene > $p - \text{CH}_3 - \text{C}_6\text{H}_4 - \text{NO}_2$ > $p - \text{O}_2\text{N} - \text{C}_6\text{H}_4 - \text{NO}_2$

48)

5

(i) Certain plants, e.g. Pinus, Juniparus, Quercus, Pyrus and Vitis can metabolise nitrogen oxide (NO) and therefore, their plantation could help in reducing photochemical smog.

(ii) Liquefied CO_2 with a suitable detergent is used for dry cleaning and H_2O_2 is used for the better results and makes use of lesser amount of water.

(iii) Soaps are 100% biodegradable so they should be used in place of detergents. Now-a-days biodegradable detergents are available. Therefore, they should be used in place of non-biodegradable hard detergents.

(iv) CNG should be used as it causes much less pollution. Moreover, electrical vehicles should be used to reduce the consumption of petrol and diesel