ITL PUBLIC SCHOOL
SESSION 2023-24
CLASS XI
CHEMISTRY

SUMMER ENGAGEMENT PROGRAMME

1. INVESTIGATORY PROJECT

The project should have the following outline:

- **Cover page**
- **Certificate**
- **Acknowledgement**
- **Index**
- **Abstract-** Include the keywords
- **Statement of Problem-** A clear statement of the problem/need that has given rise to the project
- **Objectives**-General & specific objectives of topic
- **Introduction-** Purpose, scientific principle involved, reactions, advantages, disadvantages, current examples, case presentation and beneficiary satisfaction.
- **Problem question-** (specific, concrete questions to which concrete answers can be given) and/ or hypotheses
- **Materials/Resources required**
- **Procedure-** Describe the experiments proposed or the observations planned to make and the detailed process of analysis of data/observations. Methods proposed should be feasible and be able to adequately answer problem question.
- **Observations/Data gathered-** Using the procedures mentioned in introduction, experiments should be conducted and data should be recorded. Interesting things that happened during the conduct of experiments should also be recorded.
- **Testing & analysis-** Data should be interpreted in terms of proposed hypothesis. It should be tabulated and interpreted with the help of graphs if possible. The interpretation should be done in an honest manner even if it does not support proposed hypothesis.
- **Discussion of result**
- **Conclusion-** Reporting and writing up the report. Discussion of new learning from the study may be covered under conclusion. This may have possible suggestions for future studies.
- **Limitation of the study-** The limitations of the study are those features of design or procedure that might have affected the interpretation of the results of study. The limitations are alternatively interpreted as flaws or shortcomings due to flawed methodology, observations, small number of experiments or non-peer reviewed nature of study etc.
- **Summary**
- **Evidence-** Photos showcasing the student performing the experiment.
- **References**

Rubrics for Assessment of Project

Parameters	*Exemplary (3)*	*Developing (2)*	*Beginner (1)*
Presentation of Factual Information	• Relevant to the topic. • Well designed with good flow and appropriate use of pictures and graphs. • Content covers the research well.	• Relevant to the topic. • Well designed with appropriate use of pictures and graphs, but not organised. • Content covered well but has few errors.	• Not relevant to the topic. • Not so well designed. Inappropriate use of pictures and graphs. • Content does not cover all the research.
Sources	• Multiple sources used (books, different websites, journals, etc)	• Few sources used.	• Relied on only one source.
Project report & Data collection	• Well defined problem with clear cut objectives and methodology. • Key concepts clearly specified and explained technically. • Work is well summarized and concluded.	• Well defined problem and methodology but objectives are not clear. • Key concepts specified and explained technically. • Work is well summarized and concluded.	• Poorly defined problem with un-clear objectives and not so appropriate methodology. • Key concepts specified but not explained technically. • Work is not summarized and concluded properly.
Depth of understanding	• Good understanding of the relevance of the project. • Extensive knowledge of not only the project but the related domain as well.	• Fair understanding of the relevance of the project. • Extensive knowledge of the project but not of the related domain.	• Poor understanding of the relevance of the project. • Little knowledge of the project and the domain around but not sufficient.
Interpretation and conclusion	• In correlation with data and aim of project. • Clear conclusions based on findings.	• In correlation with data and aim of project. • Conclusions not based on findings.	• Not in correlation with data and aim of project. • No conclusions.
Journal	• Daily entries with details of discussions and brainstorming sessions with the teacher.	• Daily entries without details.	• Random entries.

2. **PRACTICAL:** All the experiments performed so far to be completed in the file.

3. **ASSIGNMENT:** All the assignment questions of chapters 1 (some basic concepts of chemistry) and chapter 7 (redox reactions) to be solved in the chemistry register itself along with all solved and unsolved NCERT question.

CHAPTER- 1 (SOME BASIC CONCEPTS OF CHEMISTRY

1. Which of the following has a larger number of atoms: 1 gram of K or 1 gram of Cl_2 ?
2. When the density of the solution is 3.12 g mL^{-1}, the mass of 1.5 mL solution is _____.
3. Calculate the percentage of water of crystallization in the sample of blue vitriol ($CuSO_4.5H_2O$).
4. When 500 mL of a given 5 M solution is diluted to 1500 mL, what would be the molarity of the new solution?
5. When the glucose concentration ($C_6H_{12}O_6$) in the blood is 0.9 g L^{-1}, what would be the molarity of glucose found in the blood?
6. Assuming the density of water to be 1 g cm^{-3}, calculate the volume occupied by one molecule of water.
7. One mole of any given substance contains 6.022×10^{23} atoms/molecules. A number of molecules of H_2SO_4 that are present in 100 mL of 0.02 M H_2SO_4 solution are _____.
8. Sulphuric acid reacts with sodium hydroxide as follows:
   $H_2SO_4 + 2\,NaOH \rightarrow Na_2SO_4 + 2H_2O$
   When 1 L of 0.1 M sulphuric acid solution is allowed to react with 1 L of 0.1 M sodium hydroxide solution, what will be the amount of sodium sulphate formed and what will be its molarity in the solution so obtained?
9. Which of the following has the highest mass?
   (a) 50 g of iron
   (b) 5 moles of nitrogen gas
   (c) 1 g atom of silver
   (d) 5×10^{23} atoms of carbon
10. If the density of methanol is 0.793 Kg L^{-1}, what is its volume needed for making 2.5 L of its 0.25 M solution?
11. Which of these solutions have same molar concentration? (multiple options are also possible for this question)
    (a) 49 g H_2SO_4 per litre of solution
    (b) 49 g H_3PO_4 per litre of solution
    (c) 73 g HCl per litre of solution
    (d) 63 g HNO_3 per litre of solution
12. The empirical formula and molecular mass of a compound are CH_2O and 180 g respectively. What will be the molecular formula of the compound?
    (a) $C_9H_{18}O_9$ (b) CH_2O (c) $C_6H_{12}O_6$ (d) $C_2H_4O_2$

13. Calcium carbonate reacts with aqueous HCl to give $CaCl_2$ and CO_2 according to the reaction,

$CaCO_3$ (s) + 2 HCl (aq) → $CaCl_2$ (aq) + CO_2 (g) + H_2O (l)

What mass $CaCO_3$ is required to react completely with 25 ml of 0.75 M HCl ?

14. The reactant which is entirely consumed in reaction is known as limiting reagent. In reaction

2A + 4B → 3C + 4D

when 5 moles of A react with 6 moles of B, then

(a) Which is the limiting reagent?

(b) Calculate the amount of C formed.

15. Two containers of equal capacity A1 and A2 contain 10 grams of oxygen gas and ozone gas respectively. Which of the two will have greater number of oxygen atoms and which will have greater number of molecules?

16. In the commercial manufacture of nitric acid, how many moles of NO_2 produce 7.33 mol of HNO_3 in the reaction-

NO_2 (g) + H_2O (l) → HNO_3 (aq) + NO (g)

17. Potassium bromide KBr contains 32.9 % by mass of potassium. If 6.40 g of bromine reacts with 3.60 g of potassium, calculate the number of moles of potassium that combine with bromine to form KBr.

18. Two acids H_2SO_4 and H_3PO_4 are neutralized separately by the same amount of an alkali when sulphate and dihydrogen orthophosphate are formed respectively. Find the ratio of the masses of H_2SO_4 and H_3PO_4.

19. A crystalline salt on being rendered anhydrous loses 45.6 % of its weight. The percentage composition of the anhydrous salt is- Aluminium= 10.5 %, potassium= 15.1 %, sulphur=24.8 % and oxygen= 49.6 %. Find the simplest formula of the anhydrous and crystalline salt.

20. An organic compound containing C, H and O gave the following composition: C=40.687 %, H=5.058 %, O=54.228 %

The vapour density of the compound is 59. Calculate the molecular formula of the compound.

CHAPTER- 7 (REDOX REACTIONS)

1. The reaction- $Cl_2(g) + 2\ OH^-(aq) \rightarrow ClO^-(aq) + Cl^-(aq) + H_2O(l)$

represents the process of bleaching. Identify and name the species that bleaches the substances due to their oxidising action.

2. MnO_4^{2-} undergoes a disproportionation reaction in an acidic medium but MnO_4^- does not. Give a reason.

3. Why does fluorine not show a disproportionation reaction?

4. Nitric acid is an oxidising agent and reacts with PbO, but it does not react with PbO_2. Explain why?

5. Calculate the oxidation number of phosphorus in the following species.

(a) HPO_3^{2-} and (b) PO_4^{3-}

6. Calculate the oxidation number of each sulphur atom in the following compounds:

(a) $Na_2S_2O_3$ (b) $Na_2S_4O_6$ (c) Na_2SO_3 (d) Na_2SO_4

7. Find out the oxidation number of chlorine in the following compounds and arrange them in increasing order of oxidation number of chlorine-

$NaClO_4$, $NaClO_3$, NaClO, $KClO_2$, Cl_2O_7, ClO_3, Cl_2O, NaCl, Cl_2, ClO_2.

8. On the basis of standard electrode potential values, suggest which of the following reactions would take place? (Consult the book for E^o value).

(i) $Cu + Zn^{2+} \longrightarrow Cu^{2+} + Zn$

(ii) $Mg + Fe^{2+} \longrightarrow Mg^{2+} + Fe$

(iii) $Br_2 + 2Cl^- \longrightarrow Cl_2 + 2Br^-$

(iv) $Fe + Cd^{2+} \longrightarrow Cd + Fe^{2+}$

9. Identify the redox reactions out of the following reactions and identify the oxidising and reducing agents in them.

(i) $3HCl(aq) + HNO_3(aq) \longrightarrow Cl_2(g) + NOCl(g) + 2H_2O(l)$

(ii) $HgCl_2(aq) + 2KI(aq) \longrightarrow HgI_2(s) + 2KCl(aq)$

(iii) $Fe_2O_3(s) + 3CO(g) \xrightarrow{\Delta} 2Fe(s) + 3CO_2(g)$

(iv) $PCl_3(l) + 3H_2O(l) \longrightarrow 3HCl(aq) + H_3PO_3(aq)$

(v) $4NH_3 + 3O_2(g) \longrightarrow 2N_2(g) + 6H_2O(g)$

10. Balance the following equations by the oxidation number method.

(i) $Fe^{2+} + H^+ + Cr_2O_7^{2-} \longrightarrow Cr^{3+} + Fe^{3+} + H_2O$

(ii) $I_2 + NO_3^- \longrightarrow NO_2 + IO_3^-$

(iii) $I_2 + S_2O_3^{2-} \longrightarrow I^- + S_4O_6^{2-}$

(iv) $MnO_2 + C_2O_4^{2-} \longrightarrow Mn^{2+} + CO_2$

11. Write a balanced chemical equation for the following reactions:

(i) Permanganate ion (MnO_4^-) reacts with sulphur dioxide gas in an acidic medium to produce Mn^{2+} and hydrogensulphate ion. **(Balance by ion electron method)**

(ii) Reaction of liquid hydrazine (N_2H_4) with chlorate ion (ClO_3^-) in basic medium produces nitric oxide gas and chloride ion in a gaseous state. **(Balance by oxidation number method)**

(iii) Dichlorine heptaoxide (Cl_2O_7) in gaseous state combines with an aqueous solution of hydrogen peroxide in acidic medium to give chlorite ion (ClO_2^-) and oxygen gas.

(Balance by Ion electron method)