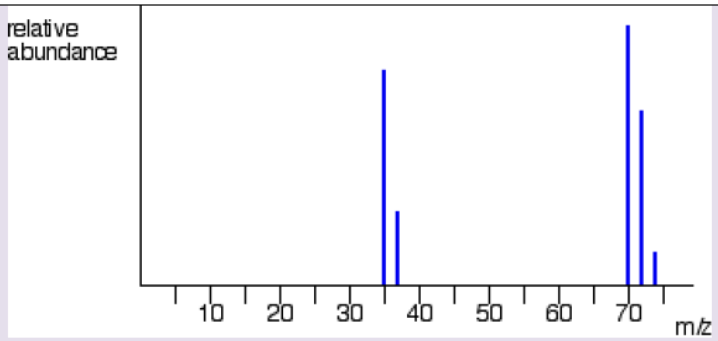
S4 CHEMISTRY EXERCISES FOR S6 REVISION

1) The atomic weight of gallium is 69.72 amu. The masses of the naturally occurring Isotopes are 68.9257 amu for 69Ga and 70.9249 amu for 71Ga. Calculate the percent abundance of each isotope

2) Use the list of the words given below to fill in the blank spaces. Each word will be used once. **Vaporization chamber, mass spectrum, velocity, ionization**, **deflection, detector, acceleration** A sample of the element is placed in the _____ chamber where it is converted into gaseous atoms. The gaseous atoms are ionized by bombardment of high energy electrons emitted by a hot cathode to become positive ions (in practice, the voltage in the _____chamber is set in such a way that only one electron is removed from each atom). The positive ions (with different masses) are then going faster to a high and constant _____by two negatively charged plates: the process is called_____. The positive ions are then deviatedby the magnet field. This process is called _____ (ions with smaller mass will be deflected more than the heavier ones). These ions are then detected by the ion _____. The information is fed into a computer which prints out the_____ of the element.

3)The spectrum mass of chlorine looks like this:



a) Explain why there are two separate groups of peaks.
b) State what causes each of the 5 lines.
c) Explain the approximate relative heights of the lines at 35 and 37.
d) Why cannot you predict the relative heights of the two clusters of lines (35/37 and 70/72/74)?

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two isotopes. (b)The mass spectrum of the sample of magnesium contains three peaks with the mass-to-charge rations and relative intensities shown below

(i) Explain why magnesium gives three peaks in mass spectrum?

m/z	24	25	26
relative intensities	1	0.127	0.139

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(ii) Use the information in the table above to calculate the accurate value for the relative atomic mass of magnesium

5)a)The frequency of hydrogen at the point of ionization is 32.810^{14}Hz.Calculate the ionization energy of hydrogen.Planck's constant h:6.610^{34}JS

b)Calculate the frequency of the fourth line of Balmer series .Given that Reydgberg constant:$1.0910^{7}m^{-1}$;

speed of electromagnetic wave:$310^{8}ms^{-1}$.Remember frequency :

c) Suppose an electron falls from n:3 to n:2

i)calculate the wave length of light emitted.

II)Calculate the energy released.Rh:109678cm^{-1} h:6.6310^{-34}JS,C:$310^{-8}ms^{-1}$

6) 1)State whether each of the following sets of quantum numbers is permissible for an electron in atom.If a set is not permissible.Explain why

i)n:3 l:1 ml:2 m(s):-1/2

ii)n:2 l:0 ml:0 m(s):1

7) a)Give electronic configuration of $Mn^{2+}$and Cu^{2+}in term of subshell.And electronic configuration of Al^{3+}using the nearest noble gas :10Ne

b)An element in period 3 has the following succive ionisation energies in Kj/mole 789,1577,3232,4356,16091,19785,23787,29253.Identify this element ,giving your reasons.

c) i)What is meant by the terms ionization energy,electronegativity,atomic radius.How do they vary in a group ,in period and why?

ii)State and explain the trend in ionization energy from Na to Cl

iii)Explain why 4Be ,5B and 15P,16S do not respect the rule

iV) The table below shows the melting points of the halides of Aluminium.

Halides	AlF_3	$AlCl_3$	$AlBr_3$	AlI_3
Melting point ^oC	1290	193	97	180

Explain in term of bonding the variation of melting point/3.5M

c)The relative molecular mass of $AlCl_3$ is 267 in vapour phase

i)Write the molecular formula of $AlCl_3$ in vapour/1M

ii)Write the structural formula to show the bonding in Aluminium chloride in vapour phase.0.5M

d)The table below shows the first ,second and third ionization energies in Kj/mol of six successive elements in the periodic table

Element	1^{st}I E	2^{nd}I E	3^{rd}I E
A	1060	1900	2920
B	1000	2260	3390
C	1260	2300	3850
D	1520	2660	3950
E	418	3070	4600
F	590	1150	4940

Note :The elements are not in one period.

a)For a given element M write equation to represent first ,second,third ionization energies.

b)From the above table ,identify the letter corresponding to an alkaline earth metal.Explain your answer

c)Which element is most likely to be a noble gas.Explain your answer.

d)Suggest the formula of a compound formed between element F and C

e)Suggest from the above table which elements are metals

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8)The table below shows some properties of barium and caesium

element	Cs	Ba
group	1	2
Atomic number	55	56
Atomic radius/nm	0.531	0.435

a)Why do caesium and barium have different atomic number?

b)Name the block in the periodic table in which caesium and barium are found.

c)Explain why the atomic radius of barium is less than atomic radius of caesium

d)Predict and explain whether a barium ion is larger,smaller or the same size as barium atom

9)a)i)predict the shape of BF_3 and PF_3

ii)Explain why BF_3 is non polar whereas PF_3 is polar?C-l bond in CCl_4 is polar but this molecule is non polar

10)a)i)Explain why sodium carbonate is more stable than magnesium carbonate.

ii)Explain this observation:-lithium iodide is sparingly soluble in water but dissolves readily in ethanol,while lithium fluoride is readily soluble in water but less soluble in ethanol

iii)Explain the trend in solubility of the hydroxides,sulphates of the elements of group two in water.

iv)What is the difference of thermal decomposition of nitrate of group I(case sodium) and those of group ii(case magnesium)

v)State four properties in which each element differs from the rest of group:Be,C,N,O,F ,B.

11)a)using silver nitrate ,it is sometimes difficult to distinguish between chloride, bromide and iodide ions.How can aqueous ammonia be used to distinguish between these ions?

b)When carring out halides tests with aqueous silver nitrate,it is important that distilled or deionised water is used for all solutions,rather than tap water suggest why.

C)Give a chemical equation between chlorine and hot concentrated sodium hydroxide.

12)a)Aluminium hydroxide is described as amphoteric .Use two relevant balanced equations to explain what is meant by the term amphoteric .Remember
$ZnO, Al_2O_3, BeO, SnO_2, PbO_2, Cr_2O_3, MnO_2$ are amphoteric oxides.

b)A solution of aluminium ions was contaminated with iron (iii) ions to leave a solution containing aluminium ions free from this impurities.Describe the expected observation at each stage

c)Explain why melting point of13 Al is higher than that of 12Mg.

d)The table below gives some data about the chlorides of elements of period 3

Formula	NaCl	$MgCl_2$	$AlCl_3$	$SiCl_4$	PCl_3	S_2Cl	Cl_2
BP	1465	1418	423	57	76	136	-36
Ph	7	6	2	2	2	1	1

Explain why BPof NaCl is higher than that of $MgCl_2$

Explain why the PH of NaCl is 7 and that of $AlCl_3$ is 2(equations)(do you know that iron(iii),chromium(iii) ions make aqueous solutions acidic?)

e) Using chemical reactions differentiate and explain the action of HCl,H2SO4 and HNO3 on aluminium metal. Do the same for Al reacting with excess of $NaOH, NH_3$

13)Explain the following observations:

a)i)Silicon tetrachloride fumes in moist air but carbon tetrachloride does not.

ii)Melting point of group iV

b) C,Si,Ge,Sn and Pb are elements of group iv in the periodic table .

i)State two important oxidation states exhibited by the elements /1M

ii)Describe how the stability of the two oxidation states vary down the group./1M

iii)Describe the type of chloride formed by these elements and show how they react with water./2.5M

iv)Define these terms:inert pair effect,allotropy of C(differenciate Diamond from graphite)

v) Explain why tetrachlorides of Si, Sn and Pb hydrolyse in water but carbon does not. Write the equations of reaction for the hydrolysis of SiCl4 and SnCl4 . . Explain why PbCl2 does not hydrolyse in water but PbCl4 does

vi) Give a chemical reagent test you can use to differentiate between HCO3- and CO32- ions and deduce the observable changes. Write the chemical equations of reactions to illustrate the reactions that have taken place in

14) a)When red lead Pb_3O_4 was reacted with nitric acid solution a solid was formed.
Write the equation for the reaction.

b)The mixture from a) was filtered and the residue warmed with conc HCl

i)What was observed?explain your answer.

ii)Write equation for the reaction

c)The filtrate from a) was divided into two parts

i)To the 1st part was added $KI_{(aq)}$what was observed and write the equation for the reation.

ii)The2nd part was evaporated to dryness and heated strongly.
Explain what was observed and write the equation for the reaction that took place.

d) i)Be and Al belong to two different groups but their chlorides present the same properties; explain the origin of that resemblance.
ii). Describethe volatility of hydrides of boron and silicon.
iii). Explain the acidity of solutions of beryllium chloride and aluminium chloride.

15) a)Explain in one line

i)Conc sulphuric acid cannot be used to prepare HB_r;HI

ii)HF is the weakest acid among hydrogen halide

iii) X2(g) $\longrightarrow$ 2X (g);Cl_2 ›B_{r2} › I_2 however F-F bond is the weakest

b)$PbCl_4$ has covalent bonds because ofa great polarizing power of Pb^{4+} .
At this oxidation state $PbCl_4$ is unstable, it changes to ……and……one of this compounds (containing Pb) has……bond

16)a)i)Give laboratory preparation of ammonia,nitric acid

ii)Industrial preparation of ammaonia,nitric acid

b)i)Write equations for ammonia reactions with:cupper oxide,oxygen,water

ii)Write equations for reactions between:conc nitric acid with copper,zinc,some non metals like C,S,P.Dil nitric acid with Mg,Cu,Zn,H_2S.

c)State any three uses of each one.

d)what are the environmental effect of productions of ammonia,nitric acid.

17)a)Give the allotropes of P_4 and their uses.Explain why one is stored in water.

b)Write chemical equations of phosphorous oxide ,chloride with water.

18) a)i)Given two hydridesH2S and H2O. Which one is more thermally stable? Justify your answer.
ii). H2O and H2S are hydrides of two elements belonging to the same group; yes H2O is liquid at room temperature, whereas H2S is gaseous. Explain why
b) i) Describe the Haber process for the manufacture of sulphuric acid.
ii) Why is sulphur trioxide formed in this process not absorbed directly in water?
c). Concentrated sulphuric acid acts as a dehydrating agent,an acid,an oxidant. What does it mean?(equations)
d). Write equations to show how concentrated sulphuric acid reacts with:
a) Zinc
b) Magnesium
c) Carbon
19)a)How sulphite is distinguished from sulphates?
b)What happen if sulphite or thiosulphates ions are in acidic medium?
c)Give the uses of the above products.
20)a) Briefly explain the trend in volatility of hydrogen halides as you move down the group. 6.
b)Explain why the hydrogen halides acidity increases in the order: HF < HCl < HBr <HI 7.
C)Explain the trend in solubility of halogens in water as you move down the group.
d)You have two test tubes; one contains water, the other contains a solution of chlorine in water, and you are asked to identify them. What test are you going to do in order to identify the two test tubes?
21)a)Halogens ,halides undergo three types of reactions.oxidation ,reduction,disproportionation.Give equations
b)Explain this statement :Halogens under the service of humanity but a geant destroying of environment.
<u>S6 EXERCISES</u>

1.Colligative properties are observed when:

(a) a non-volatile solid is dissolved in a volatile liquid
(b) a non-volatile liquid is dissolved in an another volatile liquid
(c) a gas is dissolved in a non-volatile liquid
(d) a volatile liquid is dissolved in an another volatile liquid

Mark the correct option(s).

2. Which of the following binary mixtures will have same composition in liquid and vapour phase?

(a) Benzene-Toluene
(b) Water-Nitric acid
(c) Water-Ethanol
(d) n-Hexane-n-Heptane

3. Considering the following couples of solvents, predict which mixture will show a positive deviation from Raoult's law.

(a) Methanol and acetone
(b) Chloroform and acetone
(c) Nitric acid and water
(d) Phenol and aniline

4. Relative lowering of vapour pressure is a colligative property because

(a) It depends on the concentration of a non-electrolyte solute in solution and does not depend on the nature of the solute molecules.
(b) It depends on number of particles of electrolyte solute in solution and does no t depend on the nature of the solute molecules.
(c) It depends on the concentration of anon-electrolyte solute in solution as well as on the nature of the solute molecules.
(d) It depends on the concentration of an electrolyte or a non-electrolyte solute in solution as well as on the nature of solute molecules.

Mark the correct option(s).

5. If two liquids A and B form minimum boiling azeotrope at some specific composition:

(a) A-B interactions are stronger than those between A-A or B-B
(b) Vapour pressure of solution increases because more number of molecules of liquids A and B can escape from the solution
(c) Vapour pressure of solution decreases because less number of molecules of only one of the escape from the solution
(d) A-B interactions are weaker than those between A-A or B-B.

Mark the correct option(s).

6. Colligative properties depend on
   (a) The nature of the solute particles dissolved in solution
   (b) The number of solute particles in solution
   (c) The physical properties of the solute particles dissolved in solution
   (d) The nature of the solvent particles.
   Mark the correct option(s).

7. If 0.500 grams of caffeine is dissolved in 100 mL of water, what percentage of caffeine can be separated from the water using a single 40 mL sample of methylene chloride? The distribution coefficient = 4.6

8. Benzoic acid can be separated from water using octanol as the organic solvent. The distribution coefficient for this water/octanol system is P = 1.87. Assuming that 1 gram of benzoic acid has been dissolved in 100 mL of water, how many 20 mL extractions must be done to extract 60+ percent of the benzoic acid from the water?

9. A 0.100 gram sample of phthalic acid was dissolved in 100 mL of water. When 25 mL of diethyl ether was used to extract the phthalic acid, 0.042 grams of phthalic acid were recovered. What is the distribution coefficient for this extraction?

10. What mass of ethylene glycol ($C_2H_6O_2$, molar mass=62.1 g/mol), the main component of antifreeze, must be added to 10.0 L of water to produce a solution for use in a car's radiator that freezes at -23.3°C? Assume the density of water is exactly 1g/ml. $K_f = 1.86^\circ C.Kg/mol$

11. A chemist is trying to identify a human hormone that controls metabolism by determining its molar mass. A sample weighing 0.546g was dissolved in 15.0 g benzene, and the freezing point depression was determined to be 0.240°C. Calculate the molar mass of the hormone. K_f for benzene is 5.12°C.Kg/mol.

12. To determine the molar mass of a certain protein, 1.00×10^{-3} g of it dissolved in enough water to make 1.oo mL of solution. The osmotic pressure of this solution was found to be 1.12 torr at 25.0°C. Calculate the molar mass of protein.

13. The molecular masses of polymers are determined by osmotic pressure method and not by measured other colligative properties. Give two reasons.

14. Non-ideal solutions exhibit either positive or negative deviations from Raoult's law. What are these deviations and why are they caused? Explain with one example for each type.