IGCSE-CHEMISTRY

SET-1 (QP)

Name	Parth Jain
Grade	10
School Name	BIS

Subject	**Chemistry**
Paper Code	0620
Paper	4
Marks	80
Marks Obtained	
Duration	1 hr 15 Mins
Topics	1. States of Matter 2. Atoms Elements and Compound 3. Periodic Table 4. Behaviours of Metals 5. Metallurgy

Made By
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POINTS

1.

The following are the symbols and formulae of some elements and compounds.

Ar $Ca(OH)_2$ Cl_2 CO_2 Cu Fe SO_2 V_2O_5

Answer the following questions using only the elements or compounds in the list.
Each element or compound may be used once, more than once or not at all.

State which element or compound is used:

(a) to kill bacteria in drinking water ..... Cl_2 ..... [1]

(b) as a food preservative ..... SO_2 ..... [1]

(c) as an electrical conductor in cables ..... Cu ..... [1]

(d) as an inert atmosphere in lamps ..... Ar ..... [1]

(e) to neutralise excess acidity in soil ..... $Ca(OH)_2$ ..... [1]

(f) as a catalyst in the Contact process. ..... V_2O_5 ..... [1]

POINTS

2.

Flerovium, F*l*, atomic number 114, was first made in research laboratories in 1998.

(a) Flerovium was made by bombarding atoms of plutonium, Pu, atomic number 94, with atoms of element Z. 114-94 = 20

- The nucleus of **one** atom of plutonium combined with the nucleus of **one** atom of element **Z**.
- This formed the nucleus of **one** atom of flerovium.

Suggest the identity of element **Z**.

Calcium ..... [1]

(b) In which period of the Periodic Table is flerovium?

7 ..... [1]

(c) Predict the number of outer shell electrons in an atom of flerovium.

4 ..... [1]

(d) Two isotopes of flerovium are ^{286}Fl and ^{289}Fl. The nuclei of both of these isotopes are unstable and emit energy when they split up.

(i) State the term used to describe isotopes with unstable nuclei.

Radioactive ..... [1]

(ii) Complete the table to show the number of protons, neutrons and electrons in the atoms of the isotopes shown.

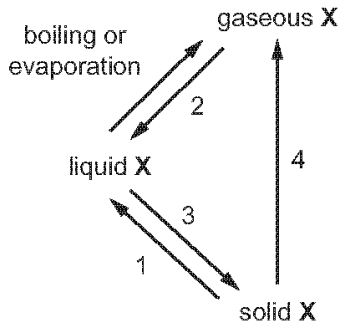
isotope	number of protons	number of neutrons	number of electrons
^{286}Fl	114	172	114
^{289}Fl	114	174	114

[2]

POINTS

3.

Element **X** can undergo the following physical changes.



(a) (i) Give the scientific name for each of the numbered physical changes.

1 Melting

2 Condensation

3 Freezing

4 Sublimation

[4]

(ii) Explain why the changes shown are physical changes.

They all involve the movement of atoms.

[1]

(iii) One difference between boiling and evaporation is the rate at which the processes occur.

State one other difference between boiling and evaporation.

Boiling is faster and not only from the surface and evaporation is slower and happens only from the surface.

[1]

(b) Describe the separation, arrangement and motion of particles of element X in the solid state.

separation particles very close together

arrangement tightly packed

motion can vibrate about their fixed position

[3]

(c) Element X is a Group I metal. It burns in air to form an oxide X_2O.

Write a chemical equation for this reaction.

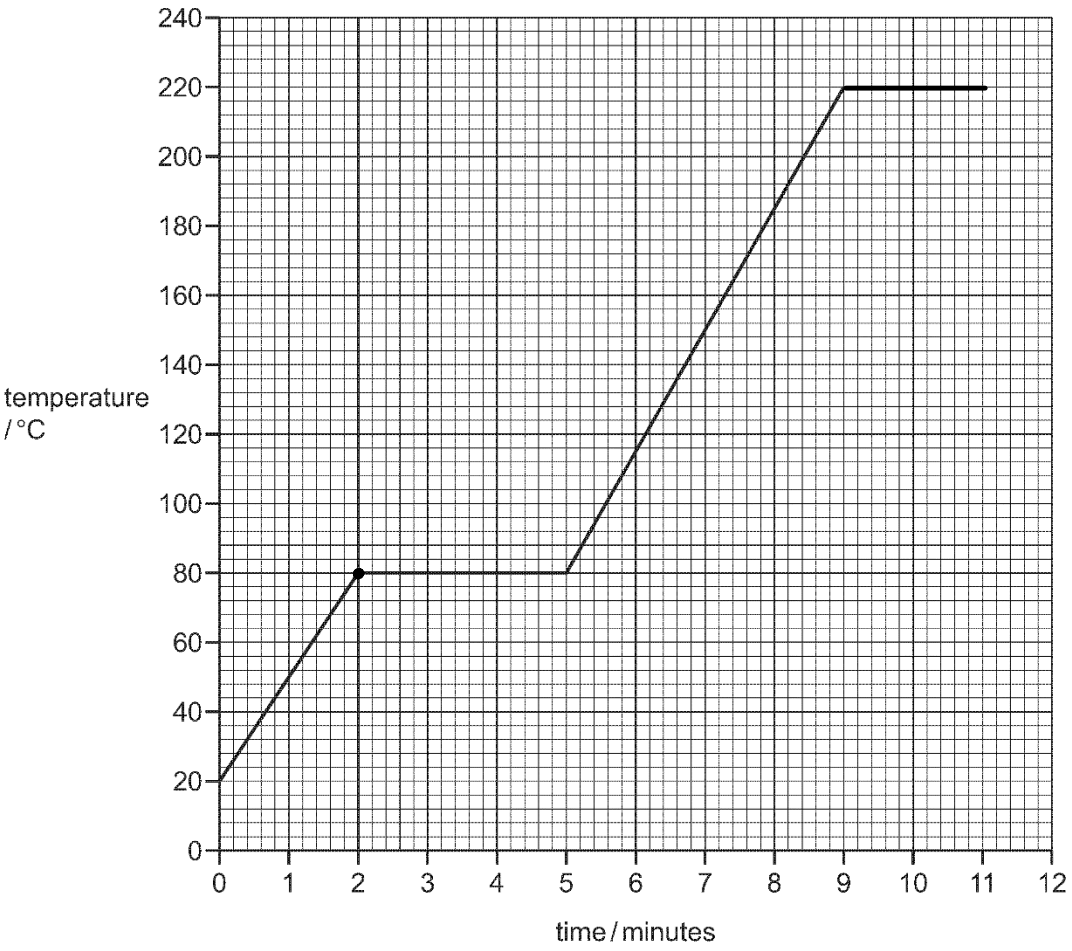
$2X + O_2 \rightarrow 2X_2O$ [2]

POINTS

4.

Z is a covalent substance. In an experiment, a sample of pure solid **Z** was continually heated for 11 minutes.

The graph shows how the temperature of the sample of pure **Z** changed during the first 9 minutes.



(a) What is the melting point of pure **Z**?

80 °C [1]

(b) The sample of pure **Z** began to boil at 9 minutes. It was boiled for 2 minutes.

Use this information to sketch on the grid how the temperature of the sample of pure **Z** changed between 9 minutes and 11 minutes. [1]

(c) The sample of pure **Z** was continually heated between 2 minutes and 5 minutes.

Explain, in terms of attractive forces, why there was no increase in the temperature of the sample of pure **Z** between 2 minutes and 5 minutes.

Because between 2 and 5 minutes the bonds of a solid are breaking and the energy is absorbed. [2]

POINTS

(d) Describe how the motion of particles of pure **Z** changed from 0 minutes to 2 minutes.

The particles started vibrating faster and faster until their bonds broke and they became a liquid.

[2]

(e) The experiment was repeated using a solid sample of **impure Z**.

Suggest the differences, if any, in the melting point and boiling point of the sample of impure **Z** compared to the sample of pure **Z**.

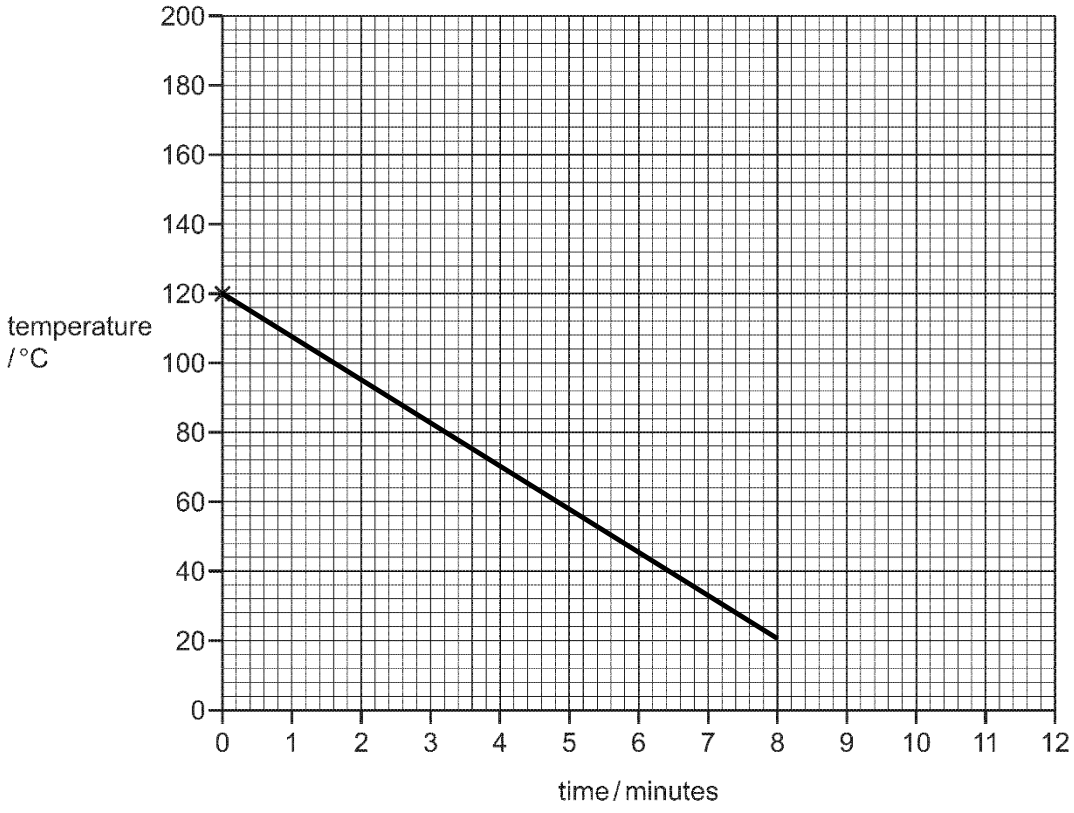
melting point ↑ses

boiling point ↑ses

[2]

(f) A sample of pure **Z** was allowed to cool from 120 °C to 20 °C. The total time taken was 8 minutes.

Starting from point ×, sketch on the grid how the temperature of the sample of pure **Z** changed between 0 minutes and 8 minutes.



[2]

POINTS

5.

Complete the following table.

particle	number of protons	number of electrons	number of neutrons	number of nucleons
$^{23}_{11}Na$	11	11	12	23
$^{37}_{17}Cl^-$	17	18	20	37
$^{56}_{26}Fe^{2+}$	26	24	30	56

[6]

6.

Magnesium, calcium and strontium are Group II elements.

(a) Complete the table to show the arrangement of electrons in a calcium atom.

shell number	1	2	3	4
number of electrons	2	8	8	2

[1]

(b) Describe how the arrangement of electrons in a strontium atom is:

(i) similar to the arrangement of electrons in a calcium atom

Same number of outer shell electrons.

(ii) different from the arrangement of electrons in a calcium atom.

different number of shells (1 more).

[2]

POINTS

7.

Magnesium exists as three isotopes, $^{24}_{12}Mg$, $^{25}_{12}Mg$ and $^{26}_{12}Mg$.

(a) State, in terms of the total numbers of electrons, neutrons and protons, **one** difference and **two** similarities between these magnesium isotopes.

difference ..different number of neutrons.....

similarity 1 ..Same no. of protons.....

similarity 2 ..same no. of electrons.....

[3]

POINTS

8.

The halogens are the elements in Group VII of the Periodic Table.

(a) Predict the physical state and colour of astatine at room temperature and pressure.

physical state ... Solid .....

colour ... purple-blue-black .....

[2]

(b) When chlorine reacts with aqueous potassium bromide a displacement reaction occurs.

(i) Describe the colour change of the solution.

from ... red-brown ... to ... green-yellow .....

[2]

(ii) Write a chemical equation for this reaction.

$KBr_2 + Cl_2 \rightarrow KCl_2 + Br_2$ [2]

(c) Reactions occur when some aqueous solutions of halogens are added to aqueous solutions of halides.

Use the key to complete the table to show the results of adding halogens to halides.

key
✓ = reaction
✗ = no reaction

		halides		
		KCl(aq)	KBr(aq)	KI(aq)
halogens	Cl_2(aq)		✓	✓
	Br_2(aq)	✗		✓
	I_2(aq)	✗	✗	

[2]

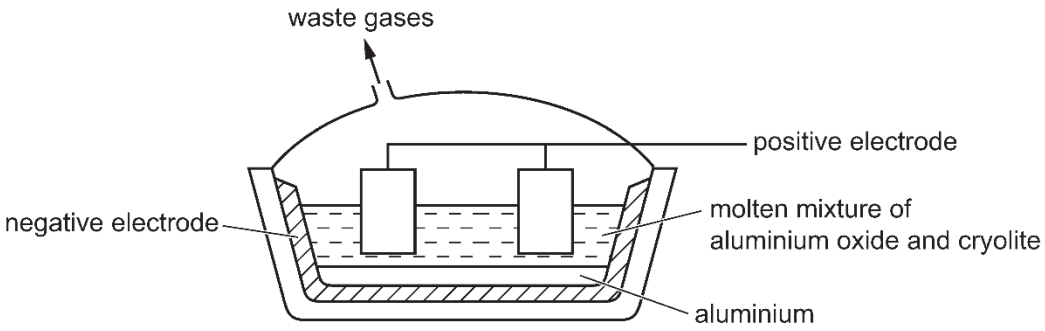
POINTS

9.

(a) Name the ore of aluminium which mainly consists of aluminium oxide.

Bauxite ..... [1]

(b) Aluminium is produced by the electrolysis of aluminium oxide dissolved in molten cryolite.



(i) Give **two** reasons why the electrolysis is done using a molten mixture of aluminium oxide and cryolite instead of molten aluminium oxide only.

1 It improves mobility and conductivity of ions .....

2 It lowers the activation energy required .....

[2]

(ii) Write ionic half-equations for the reactions occurring at the electrodes.

positive electrode $6O^{2-} - 12e \rightarrow 3O_2$ .....

negative electrode $4Al^{3+} + 12e \rightarrow 4Al$ .....

[2]

10.

Chromium is a transition element.

- Chromium has a high melting point.
- Chromium is a good conductor of electricity.
- Many chromium compounds are soluble in water.
- Hydrated chromium(III) sulfate is green.
- Chromium forms the chlorides $CrCl_2$ and $CrCl_3$.
- Oxides of chromium act as catalysts in the manufacture of poly(ethene).

(i) Use this information to give **two** properties of chromium which are different from properties of Group I elements such as sodium.

1 Chromium has a high melting point .....

2 Oxides of Chromium act as catalysts .....

[2]

POINTS

11.

This question is about iron.

(a) Three of the raw materials added to a blast furnace used to extract iron from hematite are coke, hematite and limestone.

Name **one** other raw material added to the blast furnace.

Air ..... [1]

(b) A series of reactions occurs in a blast furnace during the extraction of iron from hematite.

Describe these reactions.
Include:

- **one** chemical equation for the reduction of hematite
- **one** chemical equation for the formation of slag.

carbon reacts with oxygen to form CO_2, raising the temp. CO_2 reacts with C to form 2CO. Then $SiO_2 + CaO \rightarrow CaSiO_3$ (slag) which falls to the ground. Then $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

..... [5]

(c) The iron extracted from hematite using a blast furnace is impure.

Identify the main impurity in this iron and explain how it is removed in the steel-making process.

main impurity Carbon

how it is removed blow hot air so it reacts with the oxygen to form CO_2

..... [3]

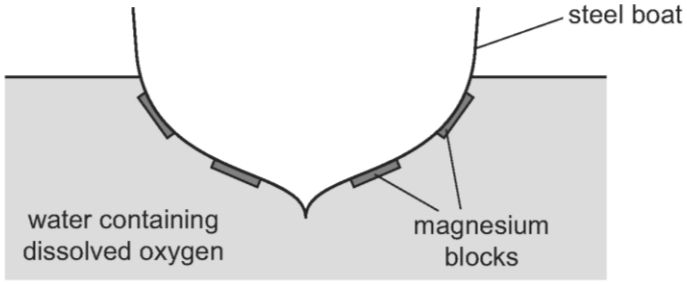
POINTS

12.

Steel consists mainly of iron.

Iron forms rust when it reacts with water and oxygen.

Magnesium blocks can be attached to the bottom of steel boats. The magnesium does not completely cover the steel.



(i) Explain how the magnesium blocks prevent iron from rusting.

Magnesium sacrificially protects Fe from rusting because it is more reactive so it reacts with the O_2 instead.

[2]

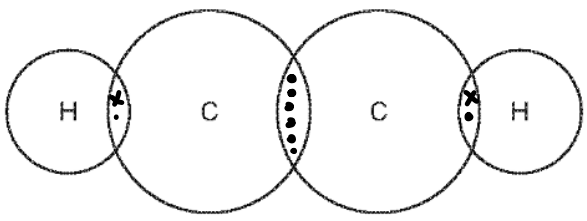
(ii) Explain why replacing the magnesium blocks with copper blocks will **not** prevent the bottom of the boat from rusting.

Copper is less reactive than Iron.

[1]

13.

Complete the dot-and-cross diagram to show the electron arrangement in a molecule of ethyne, H–C≡C–H. Show outer shell electrons only.



[2]

POINTS

14.

This question is about phosphorus and compounds of phosphorus.

(a) Phosphorus has the formula P_4. Some properties of P_4 are shown.

melting point / °C	45
boiling point / °C	280
electrical conductivity	non-conductor
solubility in water	insoluble

(i) Name the type of bonding that exists between the atoms in a P_4 molecule.

Covalent bonding ..... [1]

(ii) Explain, in terms of attractive forces between particles, why P_4 has a low melting point.

Covalent → weak forces of attraction
∴ less energy required to break bonds. ..... [1]

(iii) Explain why phosphorus is a non-conductor of electricity.

No free ions / electrons .....

..... [1]

POINTS

15.

The Periodic Table can be used to classify elements.

(a) Group I elements react with cold water to form alkaline solutions.

(i) Place the Group I elements caesium, lithium, potassium, rubidium and sodium in their order of reactivity with water.

Put the most reactive element first.

most reactive ⟶ least reactive

Cs	Rb	K	Na	Li

[1]

(ii) Name the alkaline solution formed when caesium reacts with cold water.

Caesium Hydroxide [1]

(b) Group I elements have lower melting points than transition elements.

Describe one **other** difference in the **physical** properties of Group I elements and transition elements.

group I elements [1]