Unit 9 · Chemistry of Non-Metals

WORKSHEET

Full marks 33

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 33

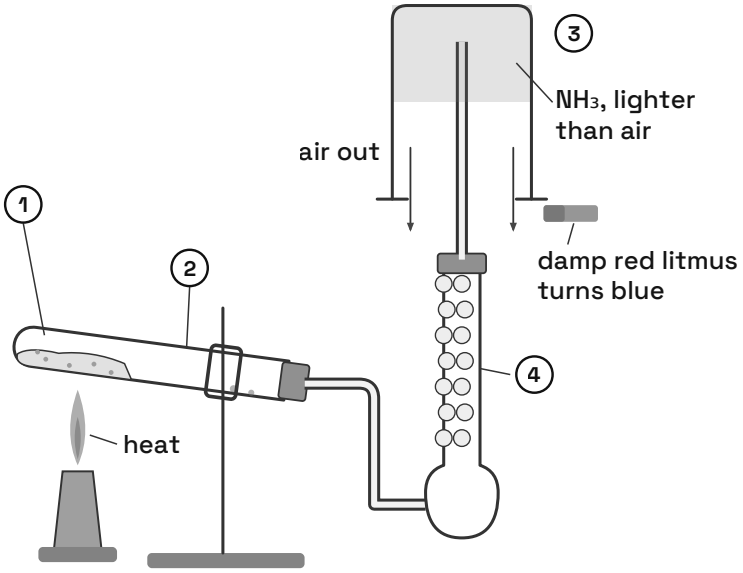
1 Key words [4]

Match each term in column A with its meaning in column B. Two meanings in column B are not needed. Each match carries 0.5 mark.

Column A		Column B	
1. nascent hydrogen	☐	**a.**	an allotrope of carbon whose molecules are hollow cages, such as C_{60}
2. heavy water	☐	**b.**	an oxide with an O–O link, in which oxygen's oxidation state is −1
3. allotropes	☐	**c.**	a mixture of carbon monoxide and hydrogen
4. amphoteric oxide	☐	**d.**	D_2O, used to slow down neutrons in some nuclear reactors
5. peroxide	☐	**e.**	different forms of the same element, with different physical properties
6. Freon	☐	**f.**	an oxide that reacts with both acids and bases
7. fullerene	☐	**g.**	hydrogen at the moment it is set free in a reaction, more reactive than H_2 gas
8. oil of vitriol	☐	**h.**	a gas that turns lead acetate paper black
		i.	concentrated sulphuric acid
		j.	a chlorofluorocarbon, such as CF_2Cl_2, that destroys ozone in the stratosphere

2 Label the diagram [2]

The diagram shows the laboratory preparation of ammonia. Write the names of the parts 1 to 4. Each carries 0.5 mark.



1. _____ **2.** _____

3. _____ **4.** _____

3 Multiple choice [5]

Choose the correct option for each of the following questions.

i. What does a hydrogen–oxygen fuel cell give out besides electricity? [1]

a. water only **b.** water and carbon dioxide

c. hydrogen peroxide **d.** ozone

ii. Why is graphite soft and slippery? [1]

a. its carbon atoms are joined by single bonds in three dimensions

b. it has delocalized electrons

c. its layers are held together only by weak van der Waals forces

d. it is made of C_{60} molecules

iii. Ammonia made in the laboratory is dried by passing it over quicklime, CaO, not through concentrated sulphuric acid. Why? [1]

a. sulphuric acid would oxidize the ammonia to nitrogen

b. ammonia is a base and would react with the acid

c. quicklime also removes the air

d. sulphuric acid is not a drying agent

iv. What is the oxidation number of nitrogen in nitrous acid, HNO_2? [1]

a. +5 **b.** +3

c. +1 **d.** −3

v. In $Cl_2 + 2\,NaOH \rightarrow NaCl + NaOCl + H_2O$ (cold, dilute alkali), what are the oxidation numbers of chlorine in the two products? **[1]**

a. 0 and −1 **b.** −1 and +1

c. −1 and +5 **d.** +1 and +5

4 Short answers [7]

Write short answers to the following questions.

a. Carbon monoxide is called the "silent killer". Why is it so dangerous? **[2]**

b. Why does a solution of hydrogen peroxide stored in a clear bottle on a sunny shelf lose its strength, and how should it be stored? **[2]**

c. Arrange chlorine, bromine and iodine in order of their oxidizing power. Predict, with an equation where there is a reaction, what happens when a. chlorine water is added to potassium iodide solution, b. iodine is added to potassium chloride solution. **[3]**

5 Long answer [4]

Write a long answer to the following question.

Sulphuric acid acts as an acid, as an oxidizing agent and as a dehydrating agent. Give one equation for each. Why must concentrated sulphuric acid always be added slowly to water, never water to the acid?

6 Numerical problems [8]

Solve the following problems. Show your working. Take H = 1, C = 12, N = 14, O = 16, Cl = 35.5, Mn = 55, and 1 mol of gas at STP = 22.4 L.

a. Ammonia is made in the laboratory by heating ammonium chloride with slaked lime: $2\,NH_4Cl + Ca(OH)_2 \rightarrow CaCl_2 + 2\,NH_3 + 2\,H_2O$. 10.7 g of ammonium chloride is used, with excess slaked lime. [4]

i. What mass of ammonia forms?

ii. What volume does it occupy at STP?

iii. All of it is turned into urea, $2\,NH_3 + CO_2 \rightarrow NH_2CONH_2 + H_2O$. What mass of urea forms?

iv. Find the percentage of nitrogen in urea.

Answer: _____

b. i. "20 volume" hydrogen peroxide gives 20 times its own volume of oxygen at STP: $2\,H_2O_2 \rightarrow 2\,H_2O + O_2$. Find the mass of H_2O_2 in 1 L of it. [4]

ii. Chlorine is made by heating manganese dioxide with concentrated hydrochloric acid: $MnO_2 + 4\,HCl \rightarrow MnCl_2 + Cl_2 + 2\,H_2O$. What volume of chlorine at STP is made from 8.7 g of MnO_2, and what mass of HCl does it use?

Answer: _____

7 Think [3]

Anisha says, "Ozone is a poisonous gas, so the less ozone there is anywhere, the better." Explain why scientists want to keep the ozone layer high up, but want less ozone near the ground.

8 Activity: Rust takes oxygen (not marked)

Push a tuft of damp steel wool (the kind used to scrub pots) into the bottom of a narrow glass. Turn the glass upside down in a bowl of water, so that some air is trapped above the water inside. Mark the water level on the glass, and mark it again every day for four days.

Day	Height of the water inside the glass (cm)	How the steel wool looks
0		
1		
2		
3		
4		

By what fraction of the trapped air did the water rise? Which gas was used up?