CHEMISTRY · Practice paper

CHEMISTRY Practice Paper 1

NAME _____

DATE _____

QUESTIONS
30

TOTAL MARKS
133

SUGGESTED TIME
185 minutes

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Instructions

Answer all questions in the spaces provided or on lined paper. Show your working — you can earn marks for your method even if the final answer is wrong. Number each answer clearly.

1. Answer the questions about greenhouse gases and redox agents. [7 marks]

(a) State what is meant by a 'greenhouse gas' and name one greenhouse gas present in the Earth’s atmosphere. [2]

(b) Explain how carbon dioxide is released into the atmosphere during the combustion of fossil fuels. [1]

(c) Describe one possible environmental impact caused by an increase in greenhouse gases such as carbon dioxide. [1]

(d) In the following reaction, identify the oxidising agent and explain your answer in terms of oxygen transfer: [2]

$$Mg(s) + CuO(s) \rightarrow MgO(s) + Cu(s)$$

(e) Suggest why carbon dioxide is not removed from the atmosphere as quickly as it is added by combustion. [1]

2. Crude oil is very important in modern life. It is separated into fractions for different uses. [5 marks]

(a) State what crude oil is mainly made of. [1]

(b) Crude oil is separated into fractions. Give one example of a product obtained from a fraction of crude oil and state its use. [1]

(c) Describe how the viscosity and colour of hydrocarbon liquids change as the size of their molecules increases. [2]

(d) Explain why larger hydrocarbon molecules have higher boiling points than smaller ones. [1]

3. The table below shows the colours of three indicators in different solutions. [5 marks]

Indicator results for solutions A, B and C.

Solution	Litmus	Phenolphthalein	Methyl orange
A	Red	Colourless	Red
B	Blue	Pink	Yellow
C	Purple	Colourless	Yellow

(a) Using the table, state which solution is acidic, which is alkaline, and which is neutral. Explain your answers using indicator colours. [3]

(b) For solution B, state what the pH is likely to be, and justify your answer. [2]

4. This question is about ionic bonding in magnesium oxide and aluminium nitride. [5 marks]

(a) Draw a dot-and-cross diagram to show the ionic bonding in magnesium oxide (MgO). [3]

Include charges on the ions.

(b) Aluminium is in Group 3 and nitrogen is in Group 5. [2]

Using your answer to part (a) as a guide, describe how ions are formed when aluminium reacts with nitrogen to form aluminium nitride (AlN).

5. This question is about testing for gases and for halide ions. [5 marks]

(a) Describe the chemical test for ammonia gas and state the positive result. [2]

(b) A student wants to identify whether a colourless solution contains chloride ions.

i. State how the student would carry out a test for chloride ions.

ii. Name the precipitate formed and give its colour if chloride ions are present.

(ii) [2]

6. This question is about the unbranched alkane with seven carbon atoms. [3 marks]

(a) Write the name of this alkane. [1]

(b) Give its molecular formula. [1]

(c) Draw its displayed (structural) formula. [1]

7. A student has the following titration results: [3 marks]

Titration	Volume of NaOH (cm^3)	Concentration of NaOH (mol/dm^3)
1	22.0	0.150
2	21.5	0.150
3 (repeat)	21.7	0.150

The student used 25.0 cm^3 of hydrochloric acid of unknown concentration each time.
Use the results to calculate the mean number of moles of sodium hydroxide used to neutralise the acid.

8. State the trend in reactivity as you go down Group 1 in the Periodic Table. [1 mark]

9. **(a)** State one physical property of sodium. [1] [3 marks]

(b) Give one chemical property common to lithium, sodium and potassium. [1]

(c) Describe the appearance of potassium at room temperature. [1]

10. The table shows two hydrocarbon fractions obtained from crude oil. [3 marks]

(a) **Hydrocarbon fractions** [1]

Fraction	Approx. number of carbon atoms
Fuel gas	3
Lubricating oil	20

Which fraction is more viscous?

(b) Explain your answer to part (a). [2]

11. Explain, using the reactivity series, why copper can be extracted from copper(II) oxide by heating with carbon but magnesium cannot. [2 marks]

12. Answer all parts. [8 marks]

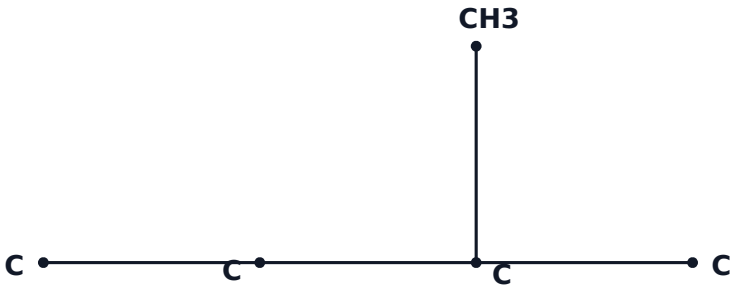
(a) Give the IUPAC name for the compound with the displayed formula: [2]



Displayed formula: (straight chain)

(b) Refinery gases are produced during the separation of crude oil. Name one typical use of refinery gases. [1]

(c) The compound below has a side chain. Use IUPAC conventions to name it. [2]



Displayed formula (side chain on third carbon):

(d) Refinery gases, gasoline and other fractions are obtained from crude oil by a particular process. Name this process and briefly describe how compounds are separated during it. [3]

13. A student wants to investigate the solubility of a compound and check whether a white powder she found is a pure substance or a mixture. [8 marks]

(a) Outline an experiment to measure the solubility of a solid in water at 40°C. State the key steps and the measurements you would record. [3]

(b) The student measures the melting point of the powder. She finds that it melts over a range from 76°C to 83°C. Explain what this result suggests about the nature of the powder. [2]

(c) Describe how melting point measurements can be used to distinguish between a pure substance and a mixture. Give an example with data. [3]

14. This question is about trends and reactions involving Group 1 alkali metals and Group 7 halogens. [8 marks]

(a) Potassium reacts vigorously with water to produce potassium hydroxide and hydrogen gas. Write a balanced chemical equation for this reaction. [1]

(b) Describe one difference you would observe in the reaction of potassium with water compared to that of lithium with water. [1]

(c) Explain, using ideas about atomic structure, why potassium is more reactive than sodium. [2]

(d) Chlorine water is added to a solution of potassium iodide.

(i) Write an ionic equation for the reaction that occurs. [2]

(ii) State one visible observation when chlorine water is added to potassium iodide solution and explain why this occurs, referring to relative reactivity. [2]

15. A student carries out the electrolysis of molten calcium chloride ($CaCl_2$) in a laboratory using inert carbon electrodes. [6 marks]

(a) State what is meant by 'discharging an ion' during electrolysis. [2]

(b) Identify the ions in molten calcium chloride and their movement during electrolysis. [1]

(c) Write the half-equation for the discharge of chloride ions at the anode. [1]

(d) Explain, using electron transfer, what happens to a calcium ion during electrolysis. [2]

16. A molecule of ammonia has the formula NH_3. [6 marks]

(a) State what is meant by the term molecule. [1]

(b) Complete the table below for the sub-atomic particles in a nitrogen atom. [3]

Properties of sub-atomic particles in a nitrogen atom

	Relative mass	**Relative charge**	**Position in atom**
Proton			
Neutron			
Electron			

(c) Given that the atomic number of nitrogen is 7 and the mass number of its most common isotope is 14:

(i) Calculate the number of neutrons in a nitrogen atom. [1]

(ii) Determine the total number of electrons in a molecule of ammonia (NH_3). [1]

17. A student writes the following table for three elements. [4 marks]

Element	Atomic number
Nitrogen	7
Calcium	20
Aluminium	13

Answer the following questions about the electronic configurations of these elements.

(a) What is the electronic configuration for nitrogen? [1]

(b) What is the electronic configuration for aluminium? [1]

(c) Give the electronic configuration for calcium. [1]

(d) Which of these elements has the greatest number of electron shells? Explain your answer. [1]

18. The table shows four metals and how each is extracted from its ore. [4 marks]

Metal	Extraction Method
Gold	Found uncombined
Iron	Reduction with carbon
Aluminium	Electrolysis
Copper	Roasting ore then reduction

Use the information in the table to answer the questions.

(a) Which of the four metals is the most reactive? Explain your choice. [1]

(b) Which metal in the table is least likely to be found as an ore? Give a reason. [1]

(c) Suggest why reduction with carbon is suitable for some but not all metals. [2]

19. **(a)** Describe the melting point behaviour of a pure solid and a mixture during heating. (2 marks) [2] [4 marks]

(b) A student finds that her sample of a white solid melts over the range 150°C to 163°C. What does this suggest about the purity of the sample? (2 marks) [2]

20. **(a)** Name the compounds formed when silver nitrate is added to solutions containing (i) chloride, (ii) bromide, and (iii) iodide ions. [2] [4 marks]

(b) Give the colour of each compound formed in part (a). [2]

21. **(a)** Describe the two main methods used to produce ethanol industrially. [2] [4 marks]

(b) State one condition needed for the hydration of ethene to make ethanol. [1]

(c) Suggest one reason why hydration of ethene is used in some countries instead of fermentation. [1]

22. State one advantage and one disadvantage of using high-carbon steel instead of mild steel for making nails. [2 marks]

23. Explain, in terms of proton transfer, what happens when sodium hydroxide reacts with nitric acid. Include the role of each substance as an acid or base. [3 marks]

24. The table below shows results from an experiment where a student measured the volume of oxygen gas produces at the anode when different substances are electrolysed: [4 marks]

Results of electrolysis

Substance (aq)	Bulb lights?	Volume of O2 at anode (cm^3)
Sodium sulfate	Yes	18.5
Copper(II) sulfate	Yes	17.8
Sugar	No	0
Ethanol	No	0

(a) Identify which substances are electrolytes and which are non-electrolytes. Explain your choices. [2]

(b) State what this experiment shows about the type of bonding in sugar and ethanol. [2]

25. Ethanol is a member of the alcohol homologous series. When ethanol is burned in air, it reacts with oxygen. [4 marks]

(a) Write a balanced chemical equation for the complete combustion of ethanol. [2]

(b) Give one use of ethanol as a fuel and explain why it is considered a biofuel. [2]

26. An experiment is set up in a sealed container for the reaction below, which can reach dynamic equilibrium: [8 marks]

$$\mathrm{E_2\,(g) + F_2\,(g) \rightleftharpoons 2\,EF\,(g)}$$

The concentrations of all substances are measured over time.

(a) Describe the conditions required for the system to reach dynamic equilibrium. Explain why these conditions are necessary. [2]

(b) The concentration of EF increases while E2 and F2 decrease for some time, then all concentrations level off. Explain what this shows about the rate of the forward and reverse reactions at this point. [2]

(c) If more F2 is added to the system at equilibrium, predict and explain what happens to the concentrations of E2, F2, and EF before the system settles at the new equilibrium. [2]

(d) Explain, in terms of equilibrium, why increasing the concentration of F2 can help industries to increase the yield of EF in this reaction. [2]

27. Explain why alkali metals must be stored under oil, using what happens when they are left uncovered in air. [2 marks]

28. State the meaning of the following terms: [2 marks]

(a) atom [1]

(b) molecule [1]

29. The table shows data for three simple molecular substances: [5 marks]

Substance	Relative molecular mass (Mr)	Melting point (°C)	Boiling point (°C)	Electrical conductivity
A	32	-210	-183	does not conduct
B	44	-56	-1	does not conduct
C	160	-7	59	does not conduct

(a) Describe the trend shown by the melting points and boiling points as the relative molecular mass increases. [2]

(b) Substance C is liquid at room temperature (25°C). Explain why substance C is a liquid at this temperature but substance A is a gas. [2]

(c) Explain why none of these substances conduct electricity in any state. [1]

30. A student reacts zinc with dilute hydrochloric acid to produce hydrogen gas at room temperature and pressure (rtp), according to the equation: [5 marks]

$$\mathrm{Zn\,(s) + 2\,HCl\,(aq) \longrightarrow ZnCl_2\,(aq) + H_2\,(g)}$$

The student collects exactly 0.85 mol of hydrogen gas.

(a) Calculate the volume, in dm³, of 0.85 mol of hydrogen gas at rtp. Show your working. [2]

(b) Convert your answer from part (a) into cm³. [1]

(c) Explain why a different gas produced under the same conditions and with the same number of moles would occupy the same volume. [2]

End of paper.

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