Metals and Non-metals

Standard difficulty · 20 questions · 40 marks · Time: 36 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer — 8 × 1 = 8 marks

1. Which metal cannot displace lead from lead nitrate solution?

(a) copper **(b)** aluminium **(c)** zinc **(d)** iron

2. The electronic configuration of neon (atomic number 10) is:

(a) 2, 8, 1 **(b)** 10 **(c)** 2, 7 **(d)** 2, 8

3. Which metal is a liquid at room temperature?

(a) iron **(b)** aluminium **(c)** sodium **(d)** mercury

4. The formula of the compound formed between aluminium and fluorine is:

(a) AlF_3 **(b)** AlF_2 **(c)** Al_2F **(d)** Al_3F

5. Which method is used to obtain zinc?

(a) electrolysis of its molten compound **(b)** reduction of its oxide with carbon
(c) heating its sulphide ore in air **(d)** dissolving its ore in water

6. How does sodium react with water?

(a) It reacts with cold water, forming sodium hydroxide and hydrogen
(b) It does not react with water, even as steam
(c) It does not react with cold water but reacts with hot water, forming sodium hydroxide and hydrogen
(d) It reacts only with steam, forming sodium oxide and hydrogen

7. An alloy of lead and tin is:

(a) solder **(b)** duralumin **(c)** an amalgam **(d)** brass

8. Assertion (A): Iron displaces magnesium from magnesium sulphate solution.
Reason (R): A more reactive metal displaces a less reactive metal from a solution of its salt.

(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

Section B — Short answer — 8 × 2 = 16 marks

9. Will lead react with silver nitrate solution? If it does, write the balanced equation.

10. Write the electronic configuration of argon (atomic number 18) and find its valency. Is it a metal, a non-metal or a noble gas?

11. How many electrons does an atom of sodium (atomic number 11) lose or gain to form an ion? Write the ion and its electronic configuration.

12. Why is sodium kept immersed in kerosene?

13. Write the balanced equation for the reduction of chromium(III) oxide with aluminium.

14. Write the balanced equation for burning carbon in oxygen. Is the oxide acidic, basic or amphoteric?

15. Find the percentage of iron in Fe_3O_4, and the mass of iron in 200 kg of pure Fe_3O_4. (Atomic masses: O = 16 u, Fe = 56 u)

16. Three metals P, Q and R are tested.
P does not displace Q from a solution of a salt of Q.
Q does not displace R from a solution of a salt of R.
Arrange P, Q and R in decreasing order of reactivity.

Section C — Word problems — 4 × 4 = 16 marks

17. How is zinc obtained from zinc blende (ZnS)? Write the equations.

18. Describe, with balanced equations, how aluminium is obtained from alumina (from bauxite) (Al_2O_3). What mass of aluminium can be obtained from 20 kg of pure Al_2O_3? (Atomic masses: O = 16 u, Al = 27 u)

19. Strips of aluminium are placed in solutions of copper sulphate, lead nitrate, silver nitrate. In which will a reaction take place? Write balanced equations for the reactions.

20. Lithium (atomic number 3) reacts with nitrogen (atomic number 7). (a) Write their electronic configurations. (b) Show how the ions form by transfer of electrons. (c) Write the formula and name of the compound. (d) Give two properties of the compound.

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Answer key

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Q	Answer	Working
1	**(a) copper**	reactivity series: K > Na > Ca > Mg > Al > Zn > Fe > Pb > H > Cu > Hg > Ag > Au
2	**(d) 2, 8**	shells K, L, M, N hold 2, 8, 8, … electrons
3	**(d) mercury**	—
4	**(a) AlF_3**	Al^{3+} and F^-: balance the charges
5	**(b) reduction of its oxide with carbon**	zinc is in the middle of the reactivity series
6	**(a) It reacts with cold water, forming sodium hydroxide and hydrogen**	—
7	**(a) solder**	—
8	**(d) A is false, but R is true.**	A is false: magnesium is above iron in the reactivity series, so iron cannot displace it. R is true.
9	**Yes: $Pb + 2AgNO_3 \rightarrow Pb(NO_3)_2 + 2Ag$**	lead is above silver in the reactivity series
10	**2, 8, 8; valency 0; a noble gas**	outer shell has 8 electrons
11	**Loses 1 electron; Na^+; 2, 8**	atom: 2, 8, 1
12	**It reacts so vigorously with oxygen and water in the air that it catches fire; kerosene keeps air and moisture away.**	—
13	**$Cr_2O_3 + 2Al \rightarrow 2Cr + Al_2O_3$**	—
14	**$C + O_2 \rightarrow CO_2$; acidic**	—
15	**72.41%; 144.83 kg**	3 × 56 ÷ 232
16	**R > Q > P**	a metal displaces only metals below it
17	**Roasting: $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$. Reduction with carbon: $ZnO + C \rightarrow Zn + CO$.**	—
18	**Electrolysis of the molten oxide: $2Al_2O_3 \rightarrow 4Al + 3O_2$. Mass of aluminium = 10.59 kg**	2 × 27 ÷ 102 × 20
19	**copper sulphate: $2Al + 3CuSO_4 \rightarrow Al_2(SO_4)_3 + 3Cu$; lead nitrate: $2Al + 3Pb(NO_3)_2 \rightarrow 2Al(NO_3)_3 + 3Pb$; silver nitrate: $Al + 3AgNO_3 \rightarrow Al(NO_3)_3 + 3Ag$**	aluminium displaces only metals below it in the series
20	**(a) Li: 2, 1; N: 2, 5. (b) Li loses 1 electron → Li^+ (2); N gains 3 → N^{3-} (2, 8). (c) Li_3N, lithium nitride. (d) It has a high melting point, and conducts electricity when molten or dissolved in water.**	—