

For each question there is only ONE correct answer.

Mark with a circle the letter (A, B, C, D or E) of the only correct answer on the Answer Sheet.

- The reaction between bromine and benzene is an example of
(A) addition (B) oxidation (C) substitution (D) elimination (E) reduction
- Which of the following gases under identical conditions (temperature, pressure) contains the largest number of molecules?
(A) 10 g nitrogen (B) 10 g chlorine (C) 10 g sulphur trioxide
(D) 10 g helium (E) 10 g carbon dioxide
- In which of the following substances is there **no** hydrogen bond formation between the molecules?
(A) ethanol (B) acetone (C) acetic acid
(D) acetamide (E) liquid ammonia
- Which substance is the reducing agent in the following reaction:
$$\text{Cu} + 4 \text{HNO}_3 = \text{Cu}(\text{NO}_3)_2 + 2 \text{NO}_2 + 2 \text{H}_2\text{O}$$

(A) Cu (B) HNO₃ (C) Cu(NO₃)₂
(D) NO₂ (E) H₂O
- How many bismuth ions are contained in 1 mol bismuth-sulphide whose formula is Bi₂S₃?
(A) 2 pieces (B) 1 piece (C) 2 x 96500 pieces
(D) 1.2 · 10²⁴ pieces (E) 18 · 10²³ pieces
- Which of the following molecules are polar?
(A) SO₂ (B) CO₂ (C) SO₃
(D) CH₄ (E) O₂
- Which of the following metals do not liberate H₂ gas from 1 mol/dm³ H₂SO₄?
(A) Al (B) Na (C) Zn
(D) Cu (E) Mg
- Which substances are each other's constitutional (structural) isomers?
(A) acetic acid and acetone (B) acetone and propylaldehyde
(C) formic acid and acetic acid (D) acetic acid and acetaldehyde
(E) acetone and formic acid
- The chemical formula of sodium azide is NaN₃. What mass of sodium would be found in 65 g of sodium azide?
(A) 46 g (B) 23 g (C) 35 g
(D) 50 g (E) 18 g

10. How many moles of hydrogen chloride can be found in 300 cm³ of 0.5 mol/dm³ HCl solution?
(A) 0.015 mol (B) 1.5 mol (C) 0.75 mol
(D) 0.15 mol (E) 0.075 mol
11. How many moles of FeCl₂ can be formed when 3 mol of iron reacts with 4 mol of hydrogen chloride gas? $\text{Fe} + 2 \text{HCl} = \text{FeCl}_2 + \text{H}_2$
(A) 7 mol (B) 3 mol (C) 2 mol
(D) 4 mol (E) 5 mol
12. What is the average molar mass of a mixture containing 2.5 mol of ammonia and 2.5 mol of hydrogen? The molar mass of NH₃ is 17.0 g/mol, the molar mass of H₂ is 2.0 g/mol.
(A) 19.0 g/mol (B) 4.75 g/mol (C) 2.00 g/mol
(D) 9.50 g/mol (E) 14.25 g/mol
13. 3.00 mol of sulphuric acid is dissolved in 3 kg of water. What is the percent by mass (m/m) % composition of the solution? The molar mass of H₂SO₄ is 98 g/mol.
(A) 8.93 % (m/m) (B) 49.49 % (m/m) (C) 30.44 % (m/m)
(D) 98.0 % (m/m) (E) 9.80 % (m/m)
14. Which of the following compounds would liberate one mole of hydrogen gas when two moles of it reacts with two moles of sodium?
(A) HO-CH₂CH₂-OH (B) CH₃COOH (C) CH₃OCH₃
(D) C₂H₆ (E) CH₃CHO
15. A pH value smaller than 7 would be shown by 1.0 mol/dm³ solution of
(A) fructose (B) sodium chloride (C) sodium acetate
(D) formic acid (E) ammonia
16. Aqueous NaCl solution is electrolyzed using graphite electrodes. Select the correct statement!
(A) Chlorine gas is liberated on the catode.
(B) Oxygen gas is liberated on the anode.
(C) After electrolysis the NaCl solution becomes more concentrated.
(D) On the surface of the catode reduction occurs.
(E) During the process sodium ions are reduced.
17. The rate of chemical reaction
(A) always increases with increasing pressure.
(B) decreases with decreasing temperature.
(C) increases with decreasing concentrations.
(D) can be decreased by using a catalyst.
(E) is never changed with increasing pressure.
18. Aluminium reacts with diluted hydrochloric acid. Which of the following statements is false?
(A) A redox reaction occurs. (B) Gas evolution occurs. (C) AlCl₃ is formed.

(D) Reduction of chloride occurs. (E) Oxidation of aluminium occurs.

19. Which of the following substances has the lowest melting point?

- (A) propane (B) propanol (C) propanoic acid
(D) propanal (E) propanone

20. A pH = 2 solution

- (A) has a hydroxide concentration of 10^{-2} mol/dm³.
(B) has an H_3O^+ concentration of 10^{-12} mol/dm³.
(C) of acetic acid contains 0.01 mol/dm³ CH_3COOH .
(D) of sulphuric acid contains 0.01 mol/dm³ H_2SO_4 .
(E) of hydrochloric acid contains 0.01 mol/dm³ HCl .