1. Which of the following techniques or processes may be used to separate a mixture of plant pigments into its individual components?

(A) Fractional distillation
(B) Solvent extraction
(C) Paper chromatography
(D) Centrifugation

2. The rate of a chemical reaction does NOT depend on the

(A) concentration of the reactants
(B) presence of a catalyst
(C) temperature of the reacting system
(D) energy change associated with the reaction

3. Which of the following compounds may be conveniently prepared by precipitation?

(A) Barium sulphate
(B) Sodium sulphate
(C) Copper (II) sulphate
(D) Magnesium nitrate

4. Which of the atoms represented below by their electronic configuration will most readily form a positive ion?

(A) 2, 8, 1
(B) 2, 8, 2
(C) 2, 8, 7
(D) 2, 8, 8

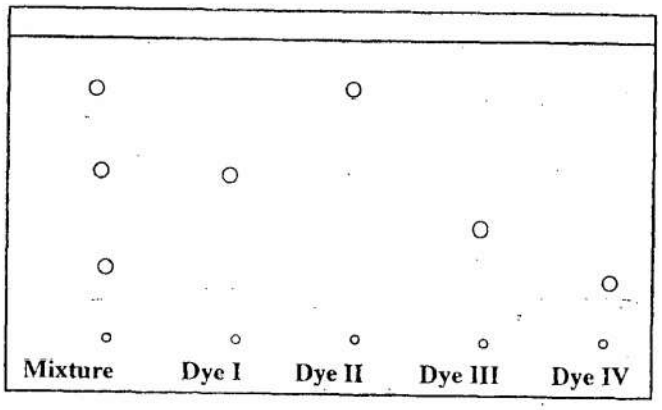
5. Particles in a solid cannot move about because the

(A) forces of attraction are very strong
(B) particles are tightly packed together
(C) particles cannot be easily compressed
(D) particles have a high density

6. Which of the following can behave both as an oxidizing agent and a reducing agent?

(A) Concentrated sulphuric acid
(B) Acidified potassium permangate (VII) solution
(C) Chlorine gas
(D) Hydrogen gas

7. The following chromatogram is obtained from the paper chromatography of a mixture of dyes and four separate dyes.



The mixture contains dyes

(A) I and II only
(B) I and III only
(C) II, III and IV only
(D) I, II and IV only

8. Which of the following aqueous solutions contains 1 mole of hydrogen ions?

(A) 1 dm^3 of 1.0 mol dm^{-3} H_2SO_4
(B) 1 dm^3 of 1 mol dm^{-3} CH_3COOH
(C) 2 dm^3 of 0.5 mol dm^{-3} H_2SO_4
(D) 2 dm^3 of 0.5 mol dm^{-3} HCl

9. When iron (III) sulphate reacts with aqueous potassium iodide, a brown coloration of iodine is produced. Which of the following deductions is correct?

(A) Iron (III) sulphate is a reducing agent.

(B) The iodide ion has been oxidised to iodine.

(C) The iron (III) sulphate has lost electrons.

(D) The iodide ion has gained electrons.

10. Sodium metal contains

I. Na^+ ions and mobile electrons.
II. Na^- ions and mobile electrons.
III. cations which repel each other.
IV. anions which repel each other.

(A) I and III only
(B) I and IV only
(C) II and III only
(D) II and IV only

11. Which of the following statements are true? Isotopes of an element contain

I. the same number of protons.
II. the same number of neutrons.
III. different numbers of electrons.
IV. the same number of protons as electrons.

(A) I and II only
(B) I and IV only
(C) II and III only
(D) II and IV only

12. Which of the following processes suggests that matter is made up of minute particles?

(A) Diffusion
(B) Capillarity
(C) Evaporation
(D) Distillation

Items **13 - 14** refer to the following alcohols.

I. CH_3OH
II. CH_3CH_2OH
III. $CH_3CH_2CH_2OH$
IV. $CH_3CHOHCH_3$

13. The two alcohols with identical molar masses are

(A) I and III
(B) II and III
(C) II and IV
(D) III and IV

14. Which alcohol contains the same number of carbon atoms as methane?

(A) I
(B) II
(C) III
(D) IV

15. Which of the following statements about chemical reactions is NOT correct?

(A) Energy is given out when bonds break and taken in when bonds form.
(B) Chemical reactions involve the making and breaking of bonds.
(C) Endothermic reactions take energy from the surroundings.
(D) Exothermic reactions give energy to the surroundings.

GO ON TO THE NEXT PAGE

Item 16 refers to 1 mole of EACH of the following acids.

I. H_2SO_4
II. CH_3COOH
III. $(COOH)_2$
IV. HNO_3

Which two of the above acids require more than one mole of NaOH(aq) for complete neutralization?

(A) I and II
(B) I and III
(C) II and III
(D) II and IV

Items 17 - 18 refer to the following types of substances. Each may be used more than once, once or not at all to answer the items below.

(A) Salt
(B) Base
(C) Alkali
(D) Acid

Which of the above substances

17. is the oxide of a metal?

18. supplies protons as the only positive ions in aqueous solutions?

19. In which of the following processes is fractional distillation NOT used?

(A) Refining of crude petroleum
(B) Separation of methanol from a methanol-water mixture
(C) Conversion of alkanes into unsaturated compounds
(D) Separation of liquid air into nitrogen and oxygen

20. Which two of the following are true about electrons, protons and neutrons in an atom?

I. Protons and neutrons are found in the nucleus.
II. Electrons can be found anywhere outside the nucleus.
III. The number of protons always equals the number of neutrons.
IV. The number of protons always equals the number of electrons.

(A) I and III
(B) I and IV
(C) II and III
(D) III and IV

21. Which of the following is NOT a mixture?

(A) Steel
(B) Brass
(C) Solder
(D) Mercury

Items 22 - 23 refer to the following sets into which elements may be placed.

(A) Group 1 elements
(B) Group 2 elements
(C) The halogens
(D) The transition elements

Select the set of elements which BEST fits the following descriptions. Each set may be used more than once, once or not at all to answer the items below.

Which set of elements

22. has molecules which contain two atoms?

23. has atoms with 2 electrons in their outer shells?

GO ON TO THE NEXT PAGE

24. Which of the following factors would NOT be expected to determine whether a particular cation would be discharged during electrolysis?

(A) The position of the cation in the electrochemical series
(B) The concentration of the cation in solution
(C) The inertness of the electrode
(D) The temperature of the solution

25. Which of the following reactions involve oxidation and reduction?

I. $Mg(s) + 2H^+(aq) \rightarrow Mg^{2+}(aq) + H_2(g)$

II. $Mg(s) + 4H^+ + 2NO_3^-(aq) \rightarrow Mg^{2+}(aq) + 2NO_2(g) + 2H_2O(l)$

III. $Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$

IV. $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$

(A) I, II and III only
(B) II, III and IV only
(C) I, II and IV only
(D) I, III and IV only

26. Crystals of sodium chloride are BEST referred to as

(A) molecular crystals
(B) macromolecular crystals
(C) metallic crystals
(D) ionic crystals

27. Study the following thermochemical equation.

$X + Y = Z, \Delta H = -B \text{ kJ mol}^{-1}$

Which of the following ways can be used to compute the value - B kJ?

I. The energy of Z minus the energy of X and Y
II. The energy of X and Y minus the energy of Z
III. The sum of the energies of X, Y and Z

(A) I only
(B) I and II only
(C) III only
(D) II and III only

28. $FeCl_2$ and $FeCl_3$ are two chlorides of iron. Which of the following statements about these two chlorides of iron are true?

I. The oxidation state of iron is different in the two chlorides.
II. The percentage of iron by mass in the two chlorides is different.
III. The colours of the aqueous solutions of the two chlorides are different.
IV. The aqueous solutions of the two chlorides do not conduct electricity.

(A) I and II only
(B) II and IV only
(C) I, II and III only
(D) II, III and IV only

29. Sulphuric acid forms the sodium salts $NaHSO_4$ and Na_2SO_4. Its basicity is therefore

(A) 1
(B) 2
(C) 3
(D) 4

GO ON TO THE NEXT PAGE

30. Barium (Ba) is an element in Group II of the periodic table. It reacts with cold water to give hydrogen and another substance of formula

(A) BaO
(B) Ba_2O
(C) BaOH
(D) $Ba(OH)_2$

Items **31 - 32** refer to the following chemicals.

(A) Zinc carbonate
(B) Magnesium metal
(C) Barium chloride
(D) Phenolphthalein

In answering items **31 - 32**, a particular choice from the above may be made more than once, once or not at all.

Which of the chemicals above

31. can be used in an acid-base titration to show that the reaction has been completed?

32. in aqueous solution, produces a white precipitate on reaction with sulphuric acid?

Item **33** refers to the table below which gives the melting and boiling points of the chlorides of four elements.

Element	m.p. of chloride/K	b.p. of chloride/K
I	210	453
II	248	348
III	973	1693
IV	193	333

33. Which of these elements would MOST likely form a chloride that is ionic in nature?

(A) I only
(B) II only
(C) III only
(D) IV only

Items **34 - 35** refer to the following terms.

(A) Isomers
(B) Polymers
(C) Allotropes
(D) Isotopes

Match each of the following descriptions with one of the terms above. Each option may be used more than once, once or not at all.

34. Solid forms of a given element which differ in physical properties

35. Compounds having the same molecular formula but different structural formulae

36. Which of the following elements reacts most vigorously with $H^+(aq)$ ions to give hydrogen gas?

(A) Zinc
(B) Lead
(C) Iron
(D) Copper

37. Potassium is a metal. From this information ONLY it may be deduced that potassium

(A) is soft
(B) is very reactive
(C) has a low melting point
(D) is a good conductor of electricity

Item 38 refers to the Haber process for the production of ammonia, according to the equation

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g) \quad \Delta H = -92 \text{ kJ mol}^{-1}$$

38. The catalyst used in this process is

(A) iron
(B) nickel
(C) platinum
(D) vanadium (V) oxide

39. When copper (II) carbonate is heated alone in a dry test tube a gas is evolved and a black residue is formed. This gas is expected to

(A) relight a glowing splint
(B) turn red litmus blue
(C) decolourize acidified aqueous potassium manganate (VII)
(D) form a white precipitate with aqueous calcium hydroxide

40. Which of the following aqueous solutions will produce a blue precipitate with aqueous sodium hydroxide?

(A) Calcium nitrate
(B) Iron (II) nitrate
(C) Copper (II) nitrate
(D) Aluminium nitrate

41. Which of the following gases are classified as pollutants of the air?

I. Nitrogen
II. Carbon monoxide
III. Hydrogen
IV. Sulphur dioxide

(A) I and III only
(B) II and IV only
(C) I, II and III only
(D) I, II and IV only

42. Many fertilisers contain ammonium salts because these salts

(A) are all very soluble in water
(B) improve the texture of the soil
(C) dissolve to give acidic solutions which keep away pests
(D) are a source of nitrogen which is essential to plant growth

43. Which of the following neither reacts with water, nor displaces hydrogen from dilute hydrochloric acid?

(A) Calcium
(B) Zinc
(C) Copper
(D) Iron

44. In the reaction between zinc and dilute sulphuric acid

(A) water is formed
(B) an insoluble salt is formed
(C) neutralisation occurs
(D) oxidation and reduction occur

45. Which of the following are arranged in order of increasing particle size?

(A) Colloids, solutions, suspensions
(B) Solutions, suspensions, colloids
(C) Suspensions, colloids, solutions
(D) Solutions, colloids, suspensions

Items 46 - 48 refer to the following organic compounds.

(A) Ethanol
(B) Ethene
(C) Ethanoic acid
(D) Ethyl ethanoate

In answering items 46 - 48 a particular choice from the above may be made more than once, once, or not at all.

Which of the organic compounds

46. undergoes addition reactions?

47. is immiscible with water and is sweet-smelling?

48. reacts with hydrogen to produce an alkane?

49. The compound ethene is described as being unsaturated. This means that the

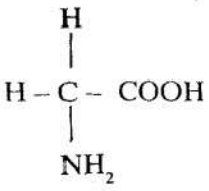
(A) carbon atoms in ethene are linked by single bonds
(B) molecule has insufficient hydrogen atoms
(C) carbon atoms in the molecule are very reactive
(D) molecule contains at least one double bond

50. Which of the following is NOT true of all homologous series of compounds?

The members of the series have

(A) the same functional group
(B) the same general formula
(C) similar chemical properties
(D) the same empirical formula

51. Which of the following types of polymers may be derived from compounds like the one below?



(A) Polyamide
(B) Polyester
(C) Polyalkene
(D) Polysaccharide

52. The process by which large molecules of hydrocarbons are broken up into smaller molecules is called

(A) saponification
(B) cracking
(C) polymerization
(D) condensation

53. The fermentation of sugars, using glucose as the substrate, can be represented by the equation

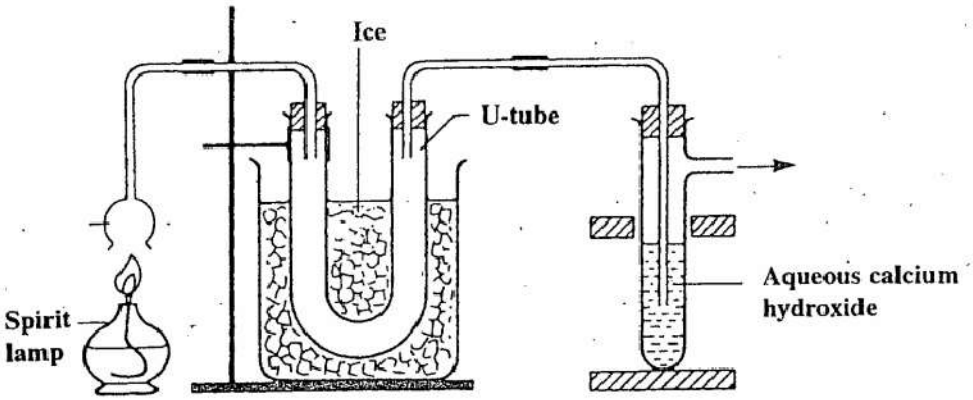
(A) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

(B) $C_6H_{12}O_6 + C_6H_{12}O_6 \rightarrow C_{12}H_{22}O_{11} + H_2O$

(C) $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$

(D) $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

Items 54 – 55 refer to the following diagram, which shows how apparatus and materials are used to identify the products formed when ethanol burns.



54. Which of the following BEST describes what will be observed in the U-tube and the test tube at the end of the investigation?

	U-tube	Test tube
(A)	Colourless liquid	Carbon dioxide
(B)	Water	White precipitate
(C)	Colourless liquid	White precipitate
(D)	Water	Carbon dioxide

55. If the ice were removed, which of the following would represent the equation for the reaction?

(A) $2\ C_2H_5OH(aq) + 7\ O_2(g) \rightarrow 4\ CO_2\ (g) + 6\ H_2O\ (l)$

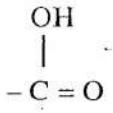
(B) $2\ C_2H_5OH(l) + 7\ O_2(g) \rightarrow 4\ CO_2\ (g) + 6\ H_2O\ (g)$

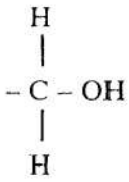
(C) $2\ C_2H_5OH(aq) + 7\ O_2(g) \rightarrow 4\ CO_2\ (g) + 6\ H_2O\ (aq)$

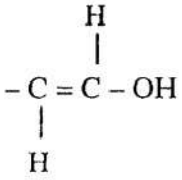
(D) $2\ C_2H_5OH(aq) + 7\ O_2(g) \rightarrow 4\ CO_2\ (g) + 6\ H_2O\ (g)$

56. The functional group present in carboxylic acids is

(A) 

(B) 

(C) 

(D) 

57. Which compound is NOT considered to be a polymer?

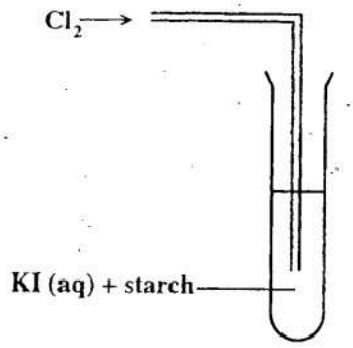
(A) Amino acids
(B) Starch
(C) Proteins
(D) Polyamides

58. The major natural source of alkanes and alkenes is

(A) petroleum
(B) natural gas
(C) the earth's crust
(D) the atmosphere

Item 59 refers to the following information.

Chlorine is bubbled into aqueous potassium iodide mixed with a few drops of aqueous starch, in the apparatus shown below.



59. What will be the colour of the solution in the test tube when the chlorine stream has stopped?

(A) Yellow-green
(B) Red-brown
(C) Yellow-green then red-brown
(D) Blue

60. A polymer has the partial structure

$-CHXCH_2CHXCH_2CHXCH_2CHXCH_2-$

The formula of the monomer would be

(A) XCH_2CH_2X

(B) $CH_3=CHX$

(C) CH_3CH_2X

(D) $CH_2=CHX$

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.