

1. A student tested a solution by adding aqueous sodium hydroxide. A precipitate was not seen because the reagent was added too quickly.
What could not have been present in the solution?

A Al^{3+} **B** Ca^{2+} **C** NH_4^+ **D** Zn^{2+}

2. What is the mass of oxygen contained in 72 g of pure water?
[Relative atomic masses: H = 1; O = 16]

A 16 g **B** 32 g **C** 64 g **D** 70 g

3. A covalent bond is formed by

A electron sharing between metals and non-metals.

B electron sharing between non-metals.

C electron transfer between non-metals.

D electron transfer from metals to non-metals.

4. Which molecule has the largest number of electrons involved in covalent bonds?

A C_2H_4 **B** CO_2 **C** CH_3OH **D** N_2

5. The equation for the reaction between calcium carbonate and hydrochloric acid is shown.



How many moles of calcium carbonate will give 24 cm³ of carbon dioxide when reacted with an excess of the acid?

(Assume one mole of carbon dioxide occupies 24 dm³.)

A 1 mol **B** 0.1 mol **C** 0.01 mol **D** 0.001 mol

6. Element X has the electronic structure 2,8,5. Element Y has the electronic structure 2,8,7.
What is the likely formula of a compound containing only X and Y?

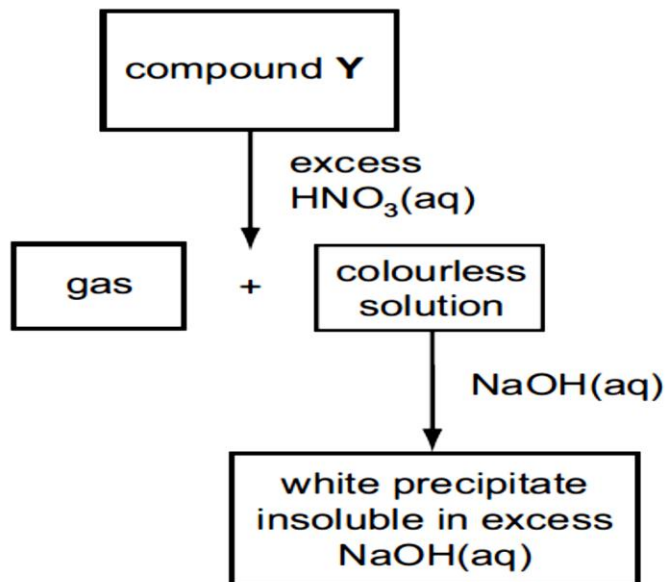
A XY_3 **B** X_2Y_3 **C** X_3Y **D** X_3Y_2

7. Carbon and silicon are both in Group IV of the Periodic Table.
Which statement is correct for both carbon dioxide and silicon dioxide?
- A** They are acidic oxides. **B** They are readily soluble in water.
C They contain ionic bonds. **D** They have giant molecular structures.
8. The following changes could be made to the conditions in the reaction between zinc and hydrochloric acid.
- 1 increase in concentration of the acid
 - 2 increase in particle size of the zinc
 - 3 increase in pressure on the system
 - 4 increase in temperature of the system

Which pair of changes will increase the rate of reaction?

- A** 1 and 2 **B** 1 and 4
C 2 and 3 **D** 3 and 4
9. Sulfur dioxide and oxygen react together.
- $$2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{SO}_3(\text{g}) \quad \Delta H = -197 \text{ kJ / mol}$$
- Which change(s) will increase both the rate of reaction and the equilibrium concentration of SO_3 ?
- 1 adding a catalyst
 - 2 increasing temperature
 - 3 increasing pressure
- A** 1 only **B** 2 **C** 1 and 3 **D** 3 only

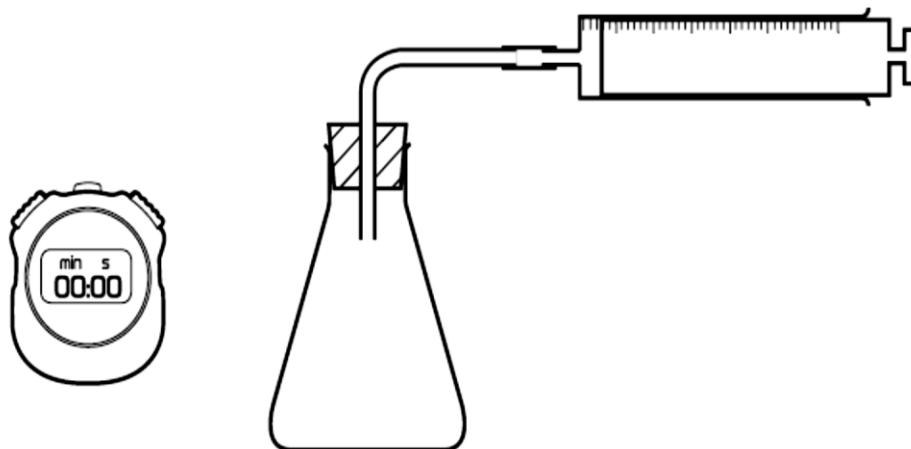
10. The scheme shows a sequence of reactions starting from compound Y.



What could the compound Y be?

- | | | | |
|----------|----------------------|----------|-------------------|
| A | aluminium sulfate | B | calcium carbonate |
| C | copper(II) carbonate | D | zinc carbonate |

11. The apparatus shown can be used to find the rate of some chemical reactions.



The rate of which reaction can be followed using this apparatus?

- | | | | |
|----------|--------------------------|----------|------------|
| A | AgNO ₃ + KI | B | Mg + HCl |
| C | NaOH + CuSO ₄ | D | NaOH + HCl |

12. Which element exists as a macromolecule?

- | | | | |
|----------|--------|----------|----------|
| A | carbon | B | hydrogen |
| C | oxygen | D | sodium |

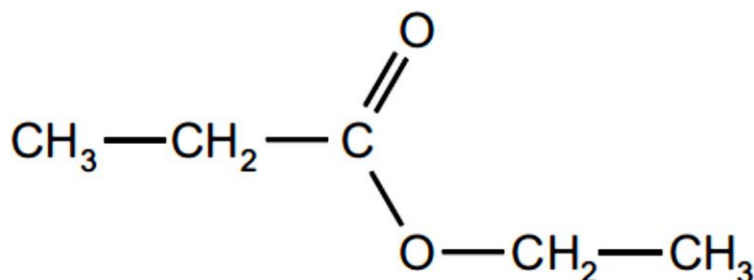
13. Which substance can conduct electricity by the movement of ions?

- | | | | |
|----------|---------|----------|-----------------|
| A | copper | B | graphite |
| C | mercury | D | sodium chloride |

14. Which process is suitable for obtaining the water from an aqueous solution of sugar?

- | | | | |
|----------|-----------------|----------|----------------------------|
| A | crystallization | B | distillation |
| C | filtration | D | use of a separating funnel |

15. The diagram shows the molecule ethyl propanoate.



Consider all the electrons in a molecule of ethyl propanoate.
How many electrons not involved in bonding are there in the molecule?

- | | | | | | | | |
|----------|---|----------|----|----------|----|----------|----|
| A | 8 | B | 10 | C | 18 | D | 22 |
|----------|---|----------|----|----------|----|----------|----|

16. Which substance does not react with hydrochloric acid?

- | | | | |
|----------|----------------|----------|----------------|
| A | zinc carbonate | B | zinc hydroxide |
| C | zinc metal | D | zinc nitrate |

17. Which change involves reduction?

- | | | | |
|----------|------------------------------------|----------|-----------------|
| A | calcium carbonate to calcium oxide | B | copper to brass |
| C | ethene to poly(ethene) | D | sand to silicon |

21. A student mixed together aqueous solutions of Y and Z. A white precipitate formed. Which could not be Y and Z?

	Y	Z
A	hydrochloric acid	silver nitrate
B	hydrochloric acid	sodium nitrate
C	sodium chloride	lead(II) nitrate
D	sodium chloride	silver nitrate

22. In which solid can layers of atoms slide over each other?

- A** diamond **B** graphite
C haematite **D** silica

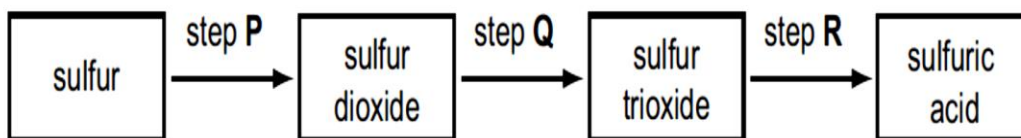
23. Which ion causes the acidity in dilute hydrochloric acid?

- A** Cl^- **B** H^+ **C** H_2^+ **D** OH^-

24. Which gas turns moist blue litmus paper red and produces a precipitate when bubbled through calcium hydroxide solution?

- A** CO **B** CO_2 **C** HCl **D** NH_3

25. The diagram shows three steps in the manufacture of sulfuric acid.



In which steps is a catalyst used?

- A** step Q only **B** step R only
C steps Q and R only **D** steps P and Q and R

26. Which process involves boiling a liquid and condensing the vapour?
- A** crystallization **B** distillation
C evaporation **D** filtration
27. Which compound, when mixed with aqueous barium nitrate, does not form a white precipitate?
- A** ammonium carbonate **B** dilute sulfuric acid
C silver nitrate **D** sodium carbonate
28. The structure of metals consists of positive ions in a 'sea of electrons'.
Which statement correctly describes what happens to the particles in the metallic heating element of an electric kettle when the kettle is switched on?
- A** Electrons move in both directions in the element.
B Electrons move in one direction only in the element.
C Electrons move in one direction and positive ions move in the opposite direction in the element.
D Positive ions move in one direction only in the element.
29. Naturally-occurring bromine has a relative atomic mass of 80 and consists entirely of two isotopes of relative atomic masses 79 and 81.
What can be deduced about naturally-occurring bromine from this information only?
- A** Bromine contains the two isotopes in equal proportions.
B Bromine has different oxidation states.
C Bromine isotopes have different numbers of protons.
D Bromine is radioactive.
30. Which ionic equation describes a redox reaction?
- A** $\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s})$
B $2\text{H}^+(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
C $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$
D $\text{Zn}(\text{s}) + \text{Cu}^{2+}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cu}(\text{s})$

31. Which is a use of sulfuric acid?

- A** as a bleach **B** in the manufacture of ammonia
C in the manufacture of fertilisers **D** in the manufacture of sulfur trioxide

32. The table shows the solubility of some compounds of metal Q in cold water.

salt	solubility in cold water
carbonate	insoluble
chloride	soluble
sulfate	insoluble

What is metal Q?

- A** barium **B** lead
C magnesium **D** sodium

33. Which two statements indicate that metal M may have a proton number between 21 and 30?

- 1** It conducts electricity.
2 It does not react with water.
3 It forms two basic oxides with formulae MO and M₂O₃.
4 It forms two coloured sulfates.

- A** 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

34. An atom of which element has the same electronic configuration as the strontium ion?

- A** calcium **B** krypton **C** rubidium **D** selenium

35. Which method will remove salt from seawater?

- A** chlorination **B** distillation **C** filtration **D** use of carbon

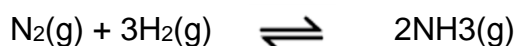
36. One volume of a gaseous element X_2 combines with an equal volume of gaseous hydrogen to form two volumes of a gaseous hydride.
What is the formula for the hydride of X?

- A** H_2X **B** HX **C** HX_2 **D** H_2X_2

37. The relative atomic mass of chlorine is 35.5.
What is the mass of 2 moles of chlorine gas?

- A** 17.75 g **B** 35.5 g **C** 71 g **D** 142 g

38. Ammonia is manufactured from nitrogen and hydrogen by the Haber process.



What is the percentage yield when 60 kg of ammonia is produced from 60 kg of hydrogen?

- A** 5.9% **B** 17.6% **C** 35.3% **D** 50.0%

39. Sodium hydrogencarbonate decomposes on heating.



In an experiment, a 5.0 mol sample of sodium hydrogencarbonate is heated.

Which volume of carbon dioxide, measured at room temperature and pressure, is evolved?

- A** 24 dm³ **B** 36 dm⁰

- C** 48 dm³ **D** 60 dm³

40. What is the number of moles of hydrogen atoms in 3.2 g of methane?

- A** 0.02 **B** 0.2 **C** 0.4 **D** 0.8