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**CHEMISTRY**  
**STANDARD LEVEL**  
**PAPER 1**

Monday 7 November 2005 (afternoon)

45 minutes

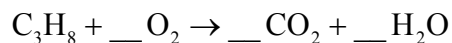
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**INSTRUCTIONS TO CANDIDATES**

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.



1. The complete oxidation of propane produces carbon dioxide and water as shown below.



What is the total of the coefficients for the **products** in the balanced equation for 1 mole of propane?

- A. 6
  - B. 7
  - C. 12
  - D. 13
2. The relative molecular mass ( $M_r$ ) of a compound is 60. Which formulas are possible for this compound?
- I.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$
  - II.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
  - III.  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III
3. Which sample has the least number of atoms?
- A. 1 mol of  $\text{H}_2\text{SO}_4$
  - B. 1 mol of  $\text{CH}_3\text{COOH}$
  - C. 2 mol of  $\text{H}_2\text{O}_2$
  - D. 2 mol of  $\text{NH}_3$

4. Avogadro's constant has the same value as the number of

- A. molecules in 1 mol of solid iodine.
- B. atoms in 1 mol of chlorine gas.
- C. ions in 1 mol of solid potassium bromide.
- D. protons in 1 mol of helium gas.

5. Information is given about four different atoms:

atom	neutrons	protons
W	22	18
X	18	20
Y	22	16
Z	20	18

Which **two** atoms are isotopes?

- A. W and Y
- B. W and Z
- C. X and Z
- D. X and Y

6. Which statement is correct about a line emission spectrum?

- A. Electrons absorb energy as they move from low to high energy levels.
- B. Electrons absorb energy as they move from high to low energy levels.
- C. Electrons release energy as they move from low to high energy levels.
- D. Electrons release energy as they move from high to low energy levels.

7. Which properties are typical of most non-metals in period 3 (Na to Ar)?
- I. They form ions by gaining one or more electrons.
  - II. They are poor conductors of heat and electricity.
  - III. They have high melting points.
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III
8. A potassium atom has a larger atomic radius than a sodium atom. Which statement about potassium correctly explains this difference?
- A. It has a larger nuclear charge.
  - B. It has a lower electronegativity.
  - C. It has more energy levels occupied by electrons.
  - D. It has a lower ionization energy.
9. When the following bond types are listed in decreasing order of strength (strongest first), what is the correct order?
- A. covalent > hydrogen > van der Waals'
  - B. covalent > van der Waals' > hydrogen
  - C. hydrogen > covalent > van der Waals'
  - D. van der Waals' > hydrogen > covalent

10. Which statement is true for most ionic compounds?
- A. They contain elements of similar electronegativity.
  - B. They conduct electricity in the solid state.
  - C. They are coloured.
  - D. They have high melting and boiling points.
11. What is the valence shell electron pair repulsion (VSEPR) theory used to predict?
- A. The energy levels in an atom
  - B. The shapes of molecules and ions
  - C. The electronegativities of elements
  - D. The type of bonding in compounds
12. Which fluoride is the most ionic?
- A. NaF
  - B. CsF
  - C.  $\text{MgF}_2$
  - D.  $\text{BaF}_2$
13. Why are gases easily compressible?
- A. They have weak intermolecular forces.
  - B. The particles have rapid, random motion.
  - C. The particles are widely spaced.
  - D. They do not have a fixed volume.

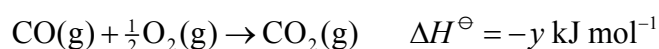
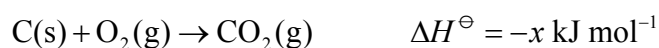
14. Why does the temperature of boiling water remain constant even though heat is supplied at a constant rate?
- A. Heat is lost to the surroundings.
  - B. The heat is used to break the covalent bonds in the water molecules.
  - C. Heat is also taken in by the container.
  - D. The heat is used to overcome the intermolecular forces of attraction between water molecules.

15. The following equation shows the formation of magnesium oxide from magnesium metal.

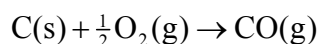


Which statement is correct for this reaction?

- A. 1204kJ of energy are released for every mol of magnesium reacted.
  - B. 602kJ of energy are absorbed for every mol of magnesium oxide formed.
  - C. 602kJ of energy are released for every mol of oxygen gas reacted.
  - D. 1204kJ of energy are released for every two mol of magnesium oxide formed.
16. The following equations show the oxidation of carbon and carbon monoxide to carbon dioxide.



What is the enthalpy change, in  $\text{kJ mol}^{-1}$ , for the oxidation of carbon to carbon monoxide?



- A.  $x + y$
- B.  $-x - y$
- C.  $y - x$
- D.  $x - y$

17. A simple calorimeter was used to determine the enthalpy of combustion of ethanol. The experimental value obtained was  $-920\text{kJ mol}^{-1}$ . The Data Booklet value is  $-1371\text{kJ mol}^{-1}$ . Which of the following best explains the difference between the two values?
- A. incomplete combustion of the fuel.
  - B. heat loss to the surroundings.
  - C. poor ventilation in the laboratory.
  - D. inaccurate temperature measurements.
18. What is the correct order of decreasing entropy for a pure substance?
- A. gas > liquid > solid
  - B. solid > liquid > gas
  - C. solid > gas > liquid
  - D. liquid > solid > gas
19. Which statement is correct for a collision between reactant particles leading to a reaction?
- A. Colliding particles must have different energy.
  - B. All reactant particles must have the same energy.
  - C. Colliding particles must have a kinetic energy higher than the activation energy.
  - D. Colliding particles must have the same velocity.
20. Which change of condition will decrease the rate of the reaction between excess zinc granules and dilute hydrochloric acid?
- A. increasing the amount of zinc
  - B. increasing the concentration of the acid
  - C. pulverize the zinc granules into powder
  - D. decreasing the temperature



21. Which changes will shift the position of equilibrium to the right in the following reaction?



- I. adding a catalyst
- II. decreasing the oxygen concentration
- III. increasing the volume of the container

- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III
22. Which statement is always true for a chemical reaction that has reached equilibrium?
- A. The yield of product(s) is greater than 50 %.
  - B. The rate of the forward reaction is greater than the rate of the reverse reaction.
  - C. The amounts of reactants and products do not change.
  - D. Both forward and reverse reactions have stopped.
23. Lime was added to a sample of soil and the pH changed from 4 to 6. What was the corresponding change in the hydrogen ion concentration?
- A. increased by a factor of 2
  - B. increased by a factor of 100
  - C. decreased by a factor of 2
  - D. decreased by a factor of 100

24. When the following  $1.0 \text{ mol dm}^{-3}$  solutions are listed in increasing order of pH (lowest first), what is the correct order?

- A.  $\text{HNO}_3 < \text{H}_2\text{CO}_3 < \text{NH}_3 < \text{Ba}(\text{OH})_2$
- B.  $\text{NH}_3 < \text{Ba}(\text{OH})_2 < \text{H}_2\text{CO}_3 < \text{HNO}_3$
- C.  $\text{Ba}(\text{OH})_2 < \text{H}_2\text{CO}_3 < \text{NH}_3 < \text{HNO}_3$
- D.  $\text{HNO}_3 < \text{H}_2\text{CO}_3 < \text{Ba}(\text{OH})_2 < \text{NH}_3$

25. Which equations represent reactions that occur at room temperature?

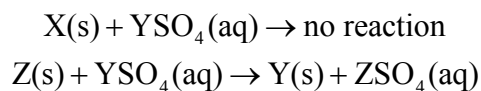
- I.  $2\text{Br}^-(\text{aq}) + \text{Cl}_2(\text{aq}) \rightarrow 2\text{Cl}^-(\text{aq}) + \text{Br}_2(\text{aq})$
- II.  $2\text{Br}^-(\text{aq}) + \text{I}_2(\text{aq}) \rightarrow 2\text{I}^-(\text{aq}) + \text{Br}_2(\text{aq})$
- III.  $2\text{I}^-(\text{aq}) + \text{Cl}_2(\text{aq}) \rightarrow 2\text{Cl}^-(\text{aq}) + \text{I}_2(\text{aq})$

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

26. Which equation represents a redox reaction?

- A.  $\text{KOH}(\text{aq}) + \text{HCl}(\text{aq}) \rightarrow \text{KCl}(\text{aq}) + \text{H}_2\text{O}(\text{l})$
- B.  $\text{Mg}(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{MgCl}_2(\text{aq}) + \text{H}_2(\text{g})$
- C.  $\text{CuO}(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CuCl}_2(\text{aq}) + \text{H}_2\text{O}(\text{l})$
- D.  $\text{ZnCO}_3(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{ZnCl}_2(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$

27. The following information is given about reactions involving the metals X, Y and Z and solutions of their sulfates.



When the metals are listed in decreasing order of reactivity (most reactive first), what is the correct order?

- A.  $\text{Z} > \text{Y} > \text{X}$
  - B.  $\text{X} > \text{Y} > \text{Z}$
  - C.  $\text{Y} > \text{X} > \text{Z}$
  - D.  $\text{Y} > \text{Z} > \text{X}$
28. How many structural isomers are possible with the molecular formula  $\text{C}_6\text{H}_{14}$ ?
- A. 4
  - B. 5
  - C. 6
  - D. 7
29. Proteins may be produced by condensation polymerisation of monomers. Which monomers are used in this reaction?
- A. esters
  - B. carboxylic acids
  - C. amino acids
  - D. alkenes
30. Which compound is a member of the aldehyde homologous series?
- A.  $\text{CH}_3\text{COCH}_3$
  - B.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
  - C.  $\text{CH}_3\text{CH}_2\text{COOH}$
  - D.  $\text{CH}_3\text{CH}_2\text{CHO}$