



**CHEMISTRY**

**Standard Level**

Thursday 6 May 1999 (afternoon)

Paper 1

45 minutes

This examination paper consists of 30 questions.

Each question offers 4 suggested answers.

The maximum mark for this paper is 30.

**INSTRUCTIONS TO CANDIDATES**

Do NOT open this examination paper until instructed to do so.

Answer ALL questions.

For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.

Calculators are NOT permitted for this examination paper.

**EXAMINATION MATERIALS**

Required:

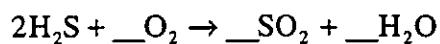
Optically Mark Read (OMR) answer sheet

Allowed:

A simple translating dictionary for candidates not working in their own language

		<b>Atomic Number</b>																<b>Atomic Mass</b>																					
1 <b>H</b> 1.01																				2 <b>He</b> 4.00																			
3 <b>Li</b> 6.94	4 <b>Be</b> 9.01																			5 <b>B</b> 10.81	6 <b>C</b> 12.01	7 <b>N</b> 14.01	8 <b>O</b> 16.00	9 <b>F</b> 19.00	10 <b>Ne</b> 20.18														
11 <b>Na</b> 22.99	12 <b>Mg</b> 24.31																			13 <b>Al</b> 26.98	14 <b>Si</b> 28.09	15 <b>P</b> 30.97	16 <b>S</b> 32.06	17 <b>Cl</b> 35.45	18 <b>Ar</b> 39.95														
19 <b>K</b> 39.10	20 <b>Ca</b> 40.08	21 <b>Sc</b> 44.96	22 <b>Ti</b> 47.90	23 <b>V</b> 50.94	24 <b>Cr</b> 52.00	25 <b>Mn</b> 54.94	26 <b>Fe</b> 55.85	27 <b>Co</b> 58.93	28 <b>Ni</b> 58.71	29 <b>Cu</b> 63.55	30 <b>Zn</b> 65.37	31 <b>Ga</b> 69.72	32 <b>Ge</b> 72.59	33 <b>As</b> 74.92	34 <b>Se</b> 78.96	35 <b>Br</b> 79.90	36 <b>Kr</b> 83.80																						
37 <b>Rb</b> 85.47	38 <b>Sr</b> 87.62	39 <b>Y</b> 88.91	40 <b>Zr</b> 91.22	41 <b>Nb</b> 92.91	42 <b>Mo</b> 95.94	43 <b>Tc</b> 98.91	44 <b>Ru</b> 101.07	45 <b>Rh</b> 102.91	46 <b>Pd</b> 106.42	47 <b>Ag</b> 107.87	48 <b>Cd</b> 112.40	49 <b>In</b> 114.82	50 <b>Sn</b> 118.69	51 <b>Sb</b> 121.75	52 <b>Te</b> 127.60	53 <b>I</b> 126.90	54 <b>Xe</b> 131.30																						
55 <b>Cs</b> 132.91	56 <b>Ba</b> 137.34	57 † <b>La</b> 138.91	72 <b>Hf</b> 178.49	73 <b>Ta</b> 180.95	74 <b>W</b> 183.85	75 <b>Re</b> 186.21	76 <b>Os</b> 190.21	77 <b>Ir</b> 192.22	78 <b>Pt</b> 195.09	79 <b>Au</b> 196.97	80 <b>Hg</b> 200.59	81 <b>Tl</b> 204.37	82 <b>Pb</b> 207.19	83 <b>Bi</b> 208.98	84 <b>Po</b> (210)	85 <b>At</b> (210)	86 <b>Rn</b> (222)																						
87 <b>Fr</b> (223)	88 <b>Ra</b> (226)	89 ‡ <b>Ac</b> (227)	104 <b>Rf</b> (261)	105 <b>Db</b> (262)	106 <b>Sg</b> (263)	107 <b>Bh</b> (262)	108 <b>Hs</b> (262)	109 <b>Mt</b> (262)																															
																			67 <b>Ho</b> 164.93	68 <b>Er</b> 167.26	69 <b>Tm</b> 168.93	70 <b>Yb</b> 173.04	71 <b>Lu</b> 174.97																
																			98 <b>Cf</b> (251)	99 <b>Es</b> (254)	100 <b>Fm</b> (257)	101 <b>Md</b> (258)	102 <b>No</b> (259)	103 <b>Lr</b> (260)															

1. Which sample has the greatest mass?
  - A. 1.0 mol of  $\text{N}_2\text{H}_4$
  - B. 2.0 mol of  $\text{N}_2$
  - C. 3.0 mol of  $\text{NH}_3$
  - D. 25.0 mol of  $\text{H}_2$
  
2. A compound contains 24 % magnesium, 28 % silicon and 48 % oxygen by mass. What is its empirical formula?
  - A.  $\text{MgSiO}$
  - B.  $\text{Mg}_2\text{SiO}$
  - C.  $\text{MgSi}_2\text{O}$
  - D.  $\text{MgSiO}_3$
  
3. What is the mass in grams of one **molecule** of propanol,  $\text{C}_3\text{H}_7\text{OH}$ ?  
(Avogadro's constant  $6.0 \times 10^{23} \text{ mol}^{-1}$ )
  - A. 60
  - B.  $1.0 \times 10^{-22}$
  - C.  $1.0 \times 10^{-23}$
  - D.  $3.6 \times 10^{25}$
  
4. Hydrogen sulfide,  $\text{H}_2\text{S}$ , reacts with oxygen to form sulfur dioxide and water as shown below:



What is the whole number coefficient for oxygen when this equation is balanced?

- A. 1
- B. 2
- C. 3
- D. 6

5. Chloroethene,  $\text{C}_2\text{H}_3\text{Cl}$ , reacts with oxygen according to the equation below:



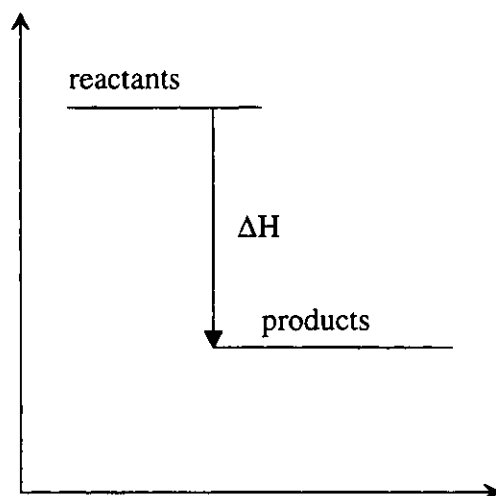
How many moles of  $\text{CO}_2$  are produced when 3.0 mol of  $\text{C}_2\text{H}_3\text{Cl}$  and 3.0 mol of  $\text{O}_2$  are reacted?

- A. 2.4
- B. 3.0
- C. 4.0
- D. 6.0
6. All isotopes of tin have the same
- I. number of protons.
- II. number of neutrons.
- III. mass number.
- A. I only
- B. II only
- C. III only
- D. I and III only
7. An element with the symbol  $Z$  has the electron configuration 2.8.6. Which species is this element most likely to form?
- A. The ion  $Z^{2+}$
- B. The ion  $Z^{6+}$
- C. The compound  $\text{H}_2Z$
- D. The compound  $Z_6\text{F}$

8. Strontium is an element in Group 2 of the Periodic Table with atomic number 38. Which of the following statements about strontium is NOT correct?
- A. Its first ionisation energy is lower than that of calcium.
  - B. It has two electrons in its outermost energy level.
  - C. Its atomic radius is smaller than magnesium.
  - D. It forms a chloride with the formula  $\text{SrCl}_2$ .
9. Which oxide is the most acidic?
- A.  $\text{Al}_2\text{O}_3$
  - B.  $\text{SiO}_2$
  - C.  $\text{P}_4\text{O}_{10}$
  - D.  $\text{SO}_3$
10. Which one of the following elements has the lowest first ionisation energy?
- A. Li
  - B. Na
  - C. Mg
  - D. Al
11. Which compound contains ionic bonds?
- A. Magnesium bromide,  $\text{MgBr}_2$
  - B. Dichloromethane,  $\text{CH}_2\text{Cl}_2$
  - C. Ethanoic acid,  $\text{CH}_3\text{COOH}$
  - D. Silicon tetrachloride,  $\text{SiCl}_4$

12. When  $\text{CH}_4$ ,  $\text{NH}_3$ ,  $\text{H}_2\text{O}$ , are arranged in order of **increasing** bond angle, what is the correct order?
- A.  $\text{CH}_4$ ,  $\text{NH}_3$ ,  $\text{H}_2\text{O}$
  - B.  $\text{NH}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{CH}_4$
  - C.  $\text{NH}_3$ ,  $\text{CH}_4$ ,  $\text{H}_2\text{O}$
  - D.  $\text{H}_2\text{O}$ ,  $\text{NH}_3$ ,  $\text{CH}_4$
13. Which one of the following bonds is the most polar?
- A. N-F
  - B. P-F
  - C. S-F
  - D. Cl-F
14. In which of the following pairs does the second substance have the lower boiling point?
- A.  $\text{F}_2$ ,  $\text{Cl}_2$
  - B.  $\text{H}_2\text{O}$ ,  $\text{H}_2\text{S}$
  - C.  $\text{C}_2\text{H}_6$ ,  $\text{C}_3\text{H}_8$
  - D.  $\text{CH}_3\text{OCH}_3$ ,  $\text{CH}_3\text{CH}_2\text{OH}$
15. The temperature (in K) is doubled for a sample of gas in a flexible container while the pressure on it is doubled. The final volume of the gas compared with the initial volume will be
- A. the same.
  - B. twice as large.
  - C. four times as large.
  - D. half as large.

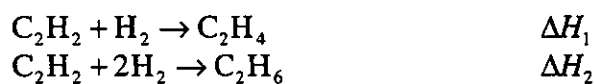
16.



What can be deduced about the relative stability of the reactants and products and the sign of  $\Delta H$ , from the enthalpy level diagram above?

<u>Relative stability</u>	<u>Sign of <math>\Delta H</math></u>
A. Products more stable	—
B. Products more stable	+
C. Reactants more stable	—
D. Reactants more stable	+

17. The enthalpy changes for two different hydrogenation reactions of  $C_2H_2$  are;

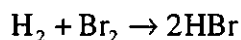


Which expression represents the enthalpy change for the reaction below?

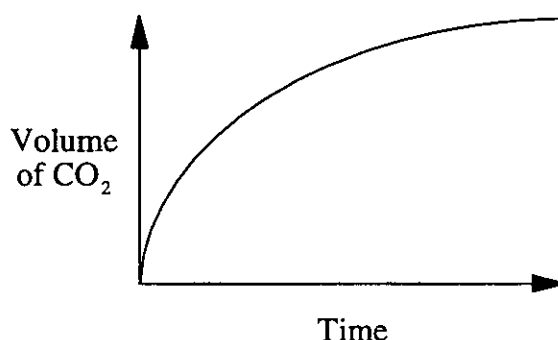


- A.  $\Delta H_1 + \Delta H_2$
- B.  $\Delta H_1 - \Delta H_2$
- C.  $\Delta H_2 - \Delta H_1$
- D.  $-\Delta H_1 - \Delta H_2$

18. The bond enthalpies for  $\text{H}_2$ ,  $\text{Br}_2$ , and  $\text{HBr}$  are 436, 193 and 368  $\text{kJ mol}^{-1}$  respectively. Calculate  $\Delta H$  for the reaction



- A. -261  
B. -107  
C. +107  
D. +261
19. The reaction between excess calcium carbonate and hydrochloric acid can be followed by measuring the volume of carbon dioxide produced with time. The results of one such reaction are shown below. How does the rate of this reaction change with time and what is the main reason for this change?



- A. The rate increases with time because the calcium carbonate particles get smaller.  
B. The rate increases with time because the acid becomes more dilute.  
C. The rate decreases with time because the calcium carbonate particles get smaller.  
D. The rate decreases with time because the acid becomes more dilute.
20. Most reactions occur in a series of steps, one of which is the rate determining step. The rate determining step is so called because it is the
- A. first step.  
B. last step.  
C. fastest step.  
D. slowest step.



21. For a reaction which goes to completion, the equilibrium constant,  $K_c$ , is

- A.  $\gg 1$
- B.  $\ll 1$
- C.  $= 1$
- D.  $= 0$

22.  $N_2O_4$  and  $NO_2$  produce an equilibrium mixture according to the equation below:



An increase in the equilibrium concentration of  $NO_2$  can be produced by increasing which of the factors below?

- I. Pressure
- II. Temperature

- A. I only
- B. II only
- C. Both I and II
- D. Neither I nor II

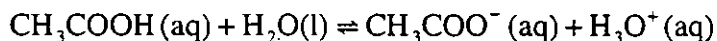
23. Four flasks labelled A, B, C and D contain equal volumes of hydrochloric acid of different concentrations. When equal volumes of 1M sodium hydroxide are added to each flask the pH values below are produced.

Flask	A	B	C	D
pH	1	5	7	13

Which flask contains the most concentrated hydrochloric acid initially?

- A. Flask A
- B. Flask B
- C. Flask C
- D. Flask D

24. In the equilibrium below, which species represent a conjugate acid–base pair?



- A.  $\text{CH}_3\text{COOH} / \text{H}_2\text{O}$
  - B.  $\text{CH}_3\text{COO}^- / \text{H}_3\text{O}^+$
  - C.  $\text{H}_2\text{O} / \text{CH}_3\text{COO}^-$
  - D.  $\text{H}_2\text{O} / \text{H}_3\text{O}^+$
25. Which one of the following equations represents an oxidation–reduction reaction?
- A.  $\text{NH}_3 + \text{HCl} \rightarrow \text{NH}_4\text{Cl}$
  - B.  $\text{SO}_3 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4$
  - C.  $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$
  - D.  $\text{HCOOH} + \text{CH}_3\text{CH}_2\text{OH} \rightarrow \text{HCOOCH}_2\text{CH}_3 + \text{H}_2\text{O}$
26. Zinc metal can supply electrons to copper ions and magnesium metal can supply electrons to zinc ions. Which is the strongest reducing agent?
- A. copper ions
  - B. zinc ions
  - C. magnesium metal
  - D. zinc metal
27. Which of the following pairs represent members of an homologous series?
- A.  $\text{C}_2\text{H}_4$  and  $\text{C}_2\text{H}_6$
  - B.  $\text{C}_2\text{H}_5\text{Cl}$  and  $\text{C}_2\text{H}_4\text{Cl}_2$
  - C.  $\text{CH}_3\text{OCH}_3$  and  $\text{CH}_3\text{CH}_2\text{OH}$
  - D.  $\text{C}_3\text{H}_7\text{COOH}$  and  $\text{C}_4\text{H}_9\text{COOH}$

28. How many different isomers have the formula  $C_4H_{10}$ ?
- A. 1  
B. 2  
C. 3  
D. 4
29. Polymers formed from monomers with the formula  $H_2C=CHX$
- A. are produced by substitution reactions.  
B. have the same percentage of carbon as the monomer.  
C. contain  $C=C$  bonds.  
D. are more reactive than the monomer.
30. Which one of the following compounds is optically active?
- A.  $CH_3CH_2CH_2CH_2NH_2$   
B.  $CH_3CH_2\underset{\substack{| \\ NH_2}}{CH}CH_3$   
C.  $CH_3CH_2\underset{\substack{| \\ H}}{N}CH_2CH_3$   
D.  $CH_3CH_2\underset{\substack{| \\ CH_3}}{N}CH_3$
-