



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

Tuesday 13 November 2001 (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.

**Periodic Table**

		Atomic Number										2																																										
		Atomic Mass																																																				
1	<b>H</b>	1.01											<b>He</b>	4.00																																								
3	<b>Li</b>	6.94	4	<b>Be</b>	9.01											10	<b>Ne</b>	20.18																																				
11	<b>Na</b>	22.99	12	<b>Mg</b>	24.31											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)																												
												†	58	<b>Ce</b>	140.12	59	<b>Pr</b>	140.91	60	<b>Nd</b>	144.24	61	<b>Pm</b>	146.92	62	<b>Sm</b>	150.35	63	<b>Eu</b>	151.96	64	<b>Gd</b>	157.25	65	<b>Tb</b>	158.92	66	<b>Dy</b>	162.50	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
												‡	90	<b>Th</b>	232.04	91	<b>Pa</b>	231.04	92	<b>U</b>	238.03	93	<b>Np</b>	(237)	94	<b>Pu</b>	(242)	95	<b>Am</b>	(243)	96	<b>Cm</b>	(247)	97	<b>Bk</b>	(247)	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)



The reaction of lead(II) sulfide with oxygen is represented by the unbalanced equation above. What is the sum of the coefficients in the **balanced** equation?

- A. 4
  - B. 5
  - C. 8
  - D. 9
2. 8.0 g of a pure compound contains 3.2 g of sulfur and 4.8 g of oxygen. What is its empirical formula?
- A. SO
  - B. SO<sub>2</sub>
  - C. SO<sub>3</sub>
  - D. S<sub>2</sub>O<sub>3</sub>
3. How many carbon atoms are present in 0.10 mol of ethanoic acid, CH<sub>3</sub>COOH ?
- A.  $6.0 \times 10^{22}$
  - B.  $1.2 \times 10^{23}$
  - C.  $6.0 \times 10^{23}$
  - D.  $1.2 \times 10^{24}$



Powdered zinc reacts with  $\text{Cu}^{2+}$  ions according to the equation above. What will be the result of adding 3.25 g of Zn to 100 cm<sup>3</sup> of 0.25 mol dm<sup>-3</sup>  $\text{CuSO}_4$  solution?

- A. All the  $\text{Cu}^{2+}$  ions react and some solid zinc remains.
- B. All the  $\text{Cu}^{2+}$  ions react and no solid zinc remains.
- C. All the solid zinc reacts and  $\text{Cu}^{2+}$  ions remain.
- D. Neither solid zinc nor  $\text{Cu}^{2+}$  ions remain.
5. Which sample contains the greatest number of ions?
- A. 25 cm<sup>3</sup> of 0.40 mol dm<sup>-3</sup> NaCl
- B. 50 cm<sup>3</sup> of 0.20 mol dm<sup>-3</sup>  $\text{MgCl}_2$
- C. 100 cm<sup>3</sup> of 0.10 mol dm<sup>-3</sup>  $\text{KNO}_3$
- D. 200 cm<sup>3</sup> of 0.05 mol dm<sup>-3</sup>  $\text{CuSO}_4$
6. Consider the composition of the particles **W**, **X**, **Y**, **Z** below. Which two particles are isotopes of the same element?

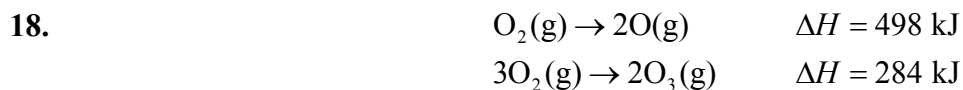
Particle	Number of protons	Number of neutrons	Number of electrons
<b>W</b>	11	12	10
<b>X</b>	12	12	12
<b>Y</b>	12	13	12
<b>Z</b>	13	14	10

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

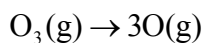
7. What is the electron configuration of an atom of element 20?
- A. 8.8.4
  - B. 4.8.8
  - C. 2.8.10
  - D. 2.8.8.2
8. Which combination will produce a reaction?
- A.  $\text{Cl}_2(\text{aq}) + 2\text{I}^-(\text{aq})$
  - B.  $\text{Br}_2(\text{aq}) + 2\text{Cl}^-(\text{aq})$
  - C.  $\text{I}_2(\text{aq}) + 2\text{Br}^-(\text{aq})$
  - D.  $\text{I}_2(\text{aq}) + 2\text{Cl}^-(\text{aq})$
9. When the species Br,  $\text{Br}^+$  and  $\text{Br}^-$  are arranged in order of increasing size (smallest first), what is the correct order?
- A.  $\text{Br} < \text{Br}^+ < \text{Br}^-$
  - B.  $\text{Br} < \text{Br}^- < \text{Br}^+$
  - C.  $\text{Br}^+ < \text{Br} < \text{Br}^-$
  - D.  $\text{Br}^- < \text{Br} < \text{Br}^+$
10. When sodium oxide and sulfur dioxide are added to separate test tubes containing water, the solutions will be, respectively,
- A. acidic and acidic.
  - B. acidic and basic.
  - C. basic and basic.
  - D. basic and acidic.

11. The compound formed between magnesium and oxygen is primarily
- A. ionic with a formula of MgO.
  - B. ionic with a formula of MgO<sub>2</sub>.
  - C. covalent with a formula of MgO.
  - D. covalent with a formula of MgO<sub>2</sub>.
12. Which substance is the most polar?
- A. CH<sub>4</sub>
  - B. CF<sub>4</sub>
  - C. CH<sub>2</sub>F<sub>2</sub>
  - D. CH<sub>2</sub>Cl<sub>2</sub>
13. The geometry and bond angle of the sulfite ion (SO<sub>3</sub><sup>2-</sup>) are best described as
- A. pyramidal, 107°.
  - B. tetrahedral, 109°.
  - C. bent, 104°.
  - D. trigonal planar, 120°.
14. As the size of the halogen molecules, X<sub>2</sub>, increases down the group, their boiling points
- A. decrease due to decreasing electronegativity.
  - B. decrease due to decreasing bond energies.
  - C. increase due to increasing permanent dipole–dipole attraction.
  - D. increase due to increasing van der Waals' forces.

15. When the pressure is increased at constant temperature, the particles in a gas will
- A. become smaller.
  - B. become larger.
  - C. move faster.
  - D. be closer together.
16. When solid ammonium nitrate dissolves in water, the temperature decreases. Which statement about the dissolving of ammonium nitrate in water is correct?
- A. It is endothermic with  $\Delta H$  greater than zero.
  - B. It is endothermic with  $\Delta H$  less than zero.
  - C. It is exothermic with  $\Delta H$  less than zero.
  - D. It is exothermic with  $\Delta H$  greater than zero.
17. When 0.01 mol of solid NaOH is added to 100 cm<sup>3</sup> of 1.0 mol dm<sup>-3</sup> HCl, the temperature increases by  $\Delta T_1$ . What will be the temperature change,  $\Delta T_2$ , for a second experiment in which the amount of NaOH and the volume of 1.0 mol dm<sup>-3</sup> HCl are each doubled?
- A.  $\Delta T_2 = \Delta T_1$
  - B.  $\Delta T_2 = \frac{1}{2} \Delta T_1$
  - C.  $\Delta T_2 = 2\Delta T_1$
  - D.  $\Delta T_2 = 4\Delta T_1$

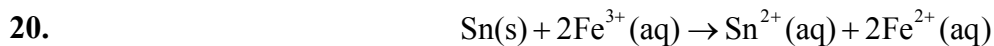


Using the information above, what is  $\Delta H$  for the following equation in kJ?



- A. 214  
B. 356  
C. 463  
D. 605
19. What are the units for the rate of a reaction?

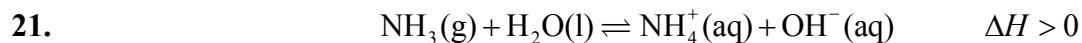
- A.  $\text{mol dm}^{-3}$   
B.  $\text{s}^{-1}$   
C.  $\text{mol dm}^{-3} \text{s}^{-1}$   
D.  $\text{dm}^3 \text{mol}^{-1} \text{s}^{-1}$



Tin metal reacts with aqueous  $\text{Fe}^{3+}$  ions according to the equation above. Which of the following factors will increase the rate of this reaction?

- I. Increasing the  $\text{Fe}^{3+}$  ion concentration  
II. Decreasing the size of the tin pieces
- A. I only  
B. II only  
C. Both I and II  
D. Neither I nor II

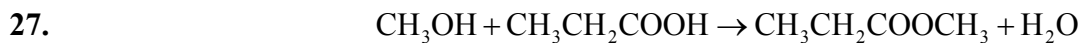




Which change increases the amount of  $\text{NH}_4^+$  ions in the above reaction?

- A. decreasing the temperature
  - B. decreasing the pressure
  - C. removing water
  - D. adding an acid
22. Which statement(s) is(are) correct about the effect of adding a catalyst to a system at equilibrium?
- I. The rate of the forward reaction increases.
  - II. The rate of the reverse reaction increases.
  - III. The yield of the products increases.
- A. I only
  - B. III only
  - C. I and II only
  - D. I, II and III
23. A Brønsted-Lowry base is defined as a substance which
- A. accepts  $\text{H}^+$  ions.
  - B. produces  $\text{OH}^-$  ions.
  - C. conducts electricity.
  - D. donates protons.

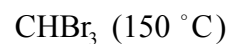
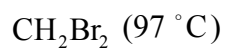
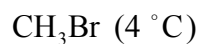
24. Which statement best describes the difference between solutions of strong and weak acids of equal concentration?
- A. Weak acid solutions have lower pH values than strong acids.
  - B. Weak acid solutions react more slowly with sodium carbonate than strong acids.
  - C. Weak acid solutions require fewer moles of base for neutralisation than strong acids.
  - D. Weak acid solutions do not react with magnesium while strong acids do.
25. What is the oxidation number of phosphorus in  $\text{NaH}_2\text{PO}_4$ ?
- A. +3
  - B. -3
  - C. +5
  - D. -5
26. Which product is formed at the cathode (negative electrode) when molten  $\text{MgCl}_2$  is electrolysed?
- A.  $\text{Mg}^{2+}$
  - B.  $\text{Cl}^-$
  - C. Mg
  - D.  $\text{Cl}_2$



The forward reaction represented by the equation above is

- A. addition.
  - B. esterification.
  - C. hydrolysis.
  - D. neutralisation.
28. Which of the following statements about single and double bonds between two carbon atoms is (are) correct?
- I. Double bonds are stronger than single bonds.
  - II. Double bonds are more reactive than single bonds.
- A. I only
  - B. II only
  - C. Both I and II
  - D. Neither I nor II
29. Which of the following is an amine?
- A.  $\text{CH}_3\text{CH}_2\text{NH}_2$
  - B.  $\text{CH}_3\text{CONH}_2$
  - C.  $-\text{[CH}_2\text{CONHCH}_2\text{CO]}_n^-$
  - D.  $\text{CH}_3\text{CH}_2\text{C} \equiv \text{N}$

30. The boiling points for several bromoalkanes are given below.



The increase in boiling points is best attributed to changes in the strengths of

- A. covalent bonds.
  - B. permanent dipole–dipole interactions.
  - C. hydrogen bonds.
  - D. van der Waals' forces.
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