



**CHEMISTRY  
STANDARD LEVEL  
PAPER 1**

Wednesday 12 May 2010 (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.
- The periodic table is provided for reference on page 2 of this examination paper.

### The Periodic Table

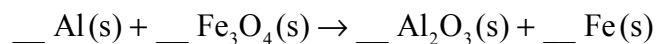
1                      2                      3                      4                      5                      6                      7                      0

	Atomic Number																
	<b>Element</b>																
	Atomic Mass																
1 <b>H</b> 1.01											2 <b>He</b> 4.00						
3 <b>Li</b> 6.94	4 <b>Be</b> 9.01											9 <b>F</b> 19.00	10 <b>Ne</b> 20.18				
11 <b>Na</b> 22.99	12 <b>Mg</b> 24.31											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)															

†	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
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‡	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)
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1. What is the coefficient of  $\text{Fe}_3\text{O}_4$  when the following equation is balanced using the lowest whole numbers?



- A. 2
- B. 3
- C. 4
- D. 5
2. What is the mass, in g, of one molecule of ethane,  $\text{C}_2\text{H}_6$ ?
- A.  $3.0 \times 10^{-23}$
- B.  $5.0 \times 10^{-23}$
- C. 30
- D.  $1.8 \times 10^{25}$
3. Which molecular formula is also an empirical formula?
- A.  $\text{PCl}_3$
- B.  $\text{C}_2\text{H}_4$
- C.  $\text{H}_2\text{O}_2$
- D.  $\text{C}_6\text{H}_{12}\text{O}_6$
4. Which of the following is consistent with Avogadro's law?
- A.  $\frac{P}{T} = \text{constant}$  ( $V, n$  constant)
- B.  $\frac{V}{T} = \text{constant}$  ( $P, n$  constant)
- C.  $Vn = \text{constant}$  ( $P, T$  constant)
- D.  $\frac{V}{n} = \text{constant}$  ( $P, T$  constant)

5. A sample of element X contains 69 % of  $^{63}\text{X}$  and 31 % of  $^{65}\text{X}$ . What is the relative atomic mass of X in this sample?
- A. 63.0  
B. 63.6  
C. 65.0  
D. 69.0
6. How many electrons does the ion  $^{31}_{15}\text{P}^{3-}$  contain?
- A. 12  
B. 15  
C. 16  
D. 18
7. What is the electron arrangement of the  $\text{Mg}^{2+}$  ion?
- A. 2,2  
B. 2,8  
C. 2,8,2  
D. 2,8,8
8. Which property **decreases** down group 7 in the periodic table?
- A. Melting point  
B. Electronegativity  
C. Atomic radius  
D. Ionic radius

9. Which oxides produce an acidic solution when added to water?



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

10. What is the formula of magnesium fluoride?



11. What is the shape of the ammonia molecule,  $\text{NH}_3$ ?

- A. Trigonal planar
- B. Trigonal pyramidal
- C. Linear
- D. V-shaped (bent)

12. Which molecule is polar?



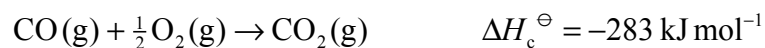
13. Which substance can form intermolecular hydrogen bonds in the liquid state?

- A.  $\text{CH}_3\text{OCH}_3$
- B.  $\text{CH}_3\text{CH}_2\text{OH}$
- C.  $\text{CH}_3\text{CHO}$
- D.  $\text{CH}_3\text{CH}_2\text{CH}_3$

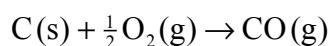
14. Which compound has a covalent macromolecular (giant covalent) structure?

- A.  $\text{MgO}(\text{s})$
- B.  $\text{Al}_2\text{O}_3(\text{s})$
- C.  $\text{P}_4\text{O}_{10}(\text{s})$
- D.  $\text{SiO}_2(\text{s})$

15. The standard enthalpy changes for the combustion of carbon and carbon monoxide are shown below.



What is the standard enthalpy change, in kJ, for the following reaction?



- A. -677
- B. -111
- C. +111
- D. +677

16. Which is correct about energy changes during bond breaking and bond formation?

	<b>Bond breaking</b>	<b>Bond formation</b>
A.	exothermic and $\Delta H$ positive	endothermic and $\Delta H$ negative
B.	exothermic and $\Delta H$ negative	endothermic and $\Delta H$ positive
C.	endothermic and $\Delta H$ positive	exothermic and $\Delta H$ negative
D.	endothermic and $\Delta H$ negative	exothermic and $\Delta H$ positive

17. Which processes are exothermic?

- I. Ice melting
  - II. Neutralization
  - III. Combustion
- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

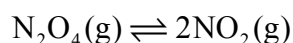
18. Which unit could be used for the rate of a chemical reaction?

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

19. Which of the following can **increase** the rate of a chemical reaction?

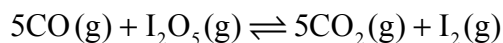
- I. Increasing the temperature
  - II. Adding a catalyst
  - III. Increasing the concentration of reactants
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III

20. What is the equilibrium constant expression,  $K_c$ , for the following reaction?



- A.  $K_c = \frac{[\text{NO}_2]}{[\text{N}_2\text{O}_4]}$
- B.  $K_c = \frac{[\text{NO}_2]^2}{[\text{N}_2\text{O}_4]}$
- C.  $K_c = \frac{[\text{NO}_2]}{[\text{N}_2\text{O}_4]^2}$
- D.  $K_c = [\text{NO}_2][\text{N}_2\text{O}_4]^2$

21. Consider the endothermic reaction below.

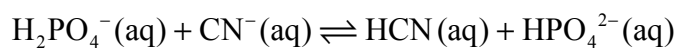


According to Le Chatelier's principle, which change would result in an increase in the amount of  $\text{CO}_2$ ?

- A. Increasing the temperature
- B. Decreasing the temperature
- C. Increasing the pressure
- D. Decreasing the pressure



22. Which species behave as Brønsted-Lowry acids in the following reversible reaction?



- A. HCN and  $\text{CN}^-$
- B. HCN and  $\text{HPO}_4^{2-}$
- C.  $\text{H}_2\text{PO}_4^-$  and  $\text{HPO}_4^{2-}$
- D. HCN and  $\text{H}_2\text{PO}_4^-$

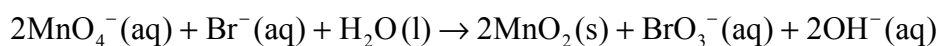
23. Which of the following are weak acids in aqueous solution?

- I.  $\text{CH}_3\text{COOH}$
  - II.  $\text{H}_2\text{CO}_3$
  - III. HCl
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III

24. In which species does sulfur have an oxidation number of 0?

- A.  $\text{SO}_3$
- B.  $\text{S}_8$
- C.  $\text{Na}_2\text{SO}_4$
- D.  $\text{H}_2\text{S}$

25. What is the reducing agent in the reaction below?



- A.  $\text{Br}^-$
- B.  $\text{BrO}_3^-$
- C.  $\text{MnO}_4^-$
- D.  $\text{MnO}_2$

26. Which changes could take place at the positive electrode (cathode) in a voltaic cell?

- I.  $\text{Zn}^{2+} (\text{aq})$  to  $\text{Zn} (\text{s})$
  - II.  $\text{Cl}_2 (\text{g})$  to  $\text{Cl}^- (\text{aq})$
  - III.  $\text{Mg} (\text{s})$  to  $\text{Mg}^{2+} (\text{aq})$
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III

27. What is the structural formula of 2,3-dibromo-3-methylhexane?

- A.  $\text{CH}_3\text{CHBrCHBrCH}(\text{CH}_3)\text{CH}_2\text{CH}_3$
- B.  $\text{CH}_3\text{CHBrCBr}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{CH}_3$
- C.  $\text{CH}_3\text{CH}_2\text{CHBrCBr}(\text{CH}_2\text{CH}_3)_2$
- D.  $\text{CH}_3\text{CHBrCHBrCH}(\text{CH}_2\text{CH}_3)_2$

28. What happens when a few drops of bromine water are added to excess hex-1-ene and the mixture is shaken?

- I. The colour of the bromine water disappears.
- II. The organic product formed does not contain any carbon-carbon double bonds.
- III. 2-bromohexane is formed.

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

29. What is the product of the following reaction?



- A.  $\text{CH}_3\text{COOH}$
- B.  $\text{CH}_3\text{COCH}_3$
- C.  $\text{CH}_3\text{CH}_2\text{COOH}$
- D.  $\text{CH}_3\text{CH}_2\text{CH}_3$

30. How many significant figures are there in 0.00370?

- A. 2
- B. 3
- C. 5
- D. 6