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**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

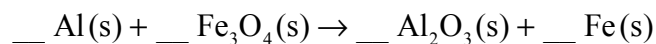
1 2 3 4 5 6 7 0

Atomic Number		Element										Atomic Mass																								
1	H	2	He	3	Li	4	Be	5	B	6	C	7	N	8	O	9	F	10	Ne																	
1.01		4.00		6.94	9.01	12	Mg	22.99	24.31	13	Al	14	Si	15	P	16	S	17	Cl	18	Ar	39.95														
19	K	20	Ca	21	Sc	22	Ti	23	V	24	Cr	25	Mn	26	Fe	27	Co	28	Ni	29	Cu	30	Zn	31	Ga	32	Ge	33	As	34	Se	35	Br	36	Kr	83.80
39.10	40.08	44.96	47.90	50.94	52.00	54.94	55.85	58.93	58.71	63.55	65.37	69.72	72.59	74.92	78.96	79.90	83.80	86	Rn	(222)																
37	Rb	38	Sr	39	Y	40	Zr	41	Nb	42	Mo	43	Tc	44	Ru	45	Rh	46	Pd	47	Ag	48	Cd	49	In	50	Sn	51	Sb	52	Te	53	I	54	Xe	131.30
85.47	87.62	88.91	91.22	92.91	95.94	98.91	101.07	102.91	106.42	107.87	112.40	114.82	118.69	121.75	126.90	127.60	131.30	85	At	(210)																
55	Cs	56	Ba	57 †	La	58	Ce	59	Pr	60	Nd	61	Pm	62	Sm	63	Eu	64	Gd	65	Tb	66	Dy	67	Ho	68	Er	69	Tm	70	Yb	71	Lu	174.97		
132.91	137.34	138.91	178.49	180.95	183.85	186.21	190.21	192.22	195.09	196.97	200.59	204.37	207.19	208.98	210	Po	(210)	84	Po	(210)																
87	Fr	88	Ra	89 ‡	Ac	(226)	(227)																													

†

‡

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?



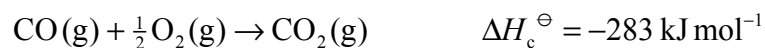
13. Which substance can form intermolecular hydrogen bonds in the liquid state?

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

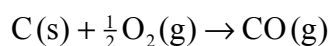
14. Which compound has a covalent macromolecular (giant covalent) structure?

- 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

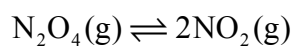
18. Which unit could be used for the rate of a chemical reaction?

- 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?

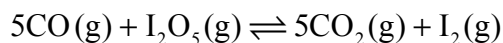
- I. Increasing the temperature
  - II. Adding a catalyst
  - III. Increasing the concentration of reactants
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III

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.

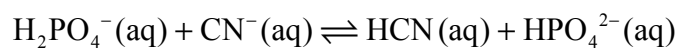


According to Le Chatelier's principle, which change would result in an increase in the amount of  $\text{CO}_2$ ?

- 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  $\text{H}_2\text{PO}_4^-$

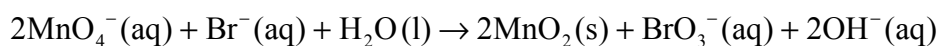
23. Which of the following are weak acids in aqueous solution?

- 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
-