



CHEMISTRY

Standard Level

Tuesday 16 November 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

889-212

11 pages

Periodic Table

		Atomic Number										Atomic Mass											
1 H 1.01																							
3 Li 6.94	4 Be 9.01																						
11 Na 22.99	12 Mg 24.31																						
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.71	29 Cu 63.55	30 Zn 65.37	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80						
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc 98.91	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.40	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.90	54 Xe 131.30						
55 Cs 132.91	56 Ba 137.34	57 † La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.21	77 Ir 192.22	78 Pt 195.09	79 Au 196.97	80 Hg 200.59	81 Tl 204.37	82 Pb 207.19	83 Bi 208.98	84 Po (210)	85 At (210)	86 Rn (222)						
87 Fr (223)	88 Ra (226)	89 ‡ Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (262)	109 Mt (262)															

58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm 146.92	62 Sm 150.35	63 Eu 151.96	64 Gd 157.25	65 Tb 158.92	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
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90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np (237)	94 Pu (242)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (254)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)
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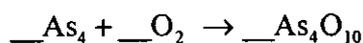
1. What is the empirical formula for a compound with the molecular formula $C_6H_3(NO_2)_3$?

- A. CHNO
- B. C_2HNO_2
- C. $(C_2HNO_2)_3$
- D. $C_6H_3N_3O_6$

2. How many moles of CH_4 are needed to obtain 6.0×10^{23} hydrogen atoms?

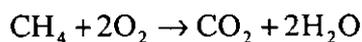
- A. $\frac{1}{4}$
- B. 1
- C. 2
- D. 4

3. Arsenic, As_4 , reacts with oxygen to produce the oxide As_4O_{10} . What is the **sum** of the coefficients for the **reactants** in the balanced equation?



- A. 4
- B. 5
- C. 6
- D. 7

4. What is the minimum number of grams of O_2 ($M_R = 32$) required to burn 1.6 grams of CH_4 ($M_R = 16$) according to the equation below?



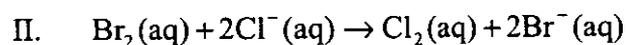
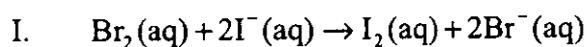
- A. 1.6
- B. 3.2
- C. 6.4
- D. 32

5. How many moles of HCl are in 25 cm³ of 0.2 mol dm⁻³ hydrochloric acid?
- A. 0.005
 - B. 0.008
 - C. 5
 - D. 8
6. Isotopes of an element differ in their:
- A. atomic number
 - B. number of neutrons
 - C. position in the Periodic Table
 - D. electronic arrangement
7. Spectra have been used to study the arrangements of electrons in atoms. An emission spectrum consists of a series of bright lines that converge at high frequencies. Such emission spectra provide evidence that electrons are moving from
- A. lower to higher energy levels with the higher energy levels being closer together.
 - B. lower to higher energy levels with the lower energy levels being closer together.
 - C. higher to lower energy levels with the lower energy levels being closer together.
 - D. higher to lower energy levels with the higher energy levels being closer together.
8. An element has the electronic configuration 2.7. What would be the electronic configuration of an element with similar chemical properties?
- A. 2.6
 - B. 2.8
 - C. 2.7.1
 - D. 2.8.7

9. Which property shows a general decrease across the Periodic Table from Na to Cl?

- A. atomic radii
- B. electronegativities
- C. ionisation energies
- D. melting points

10. Which reaction occurs readily?

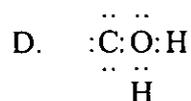
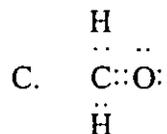
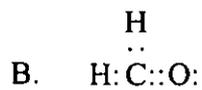


- A. I only
- B. II only
- C. Both I and II
- D. Neither I nor II

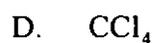
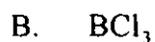
11. Which compound is most ionic?

- A. HCl
- B. KF
- C. MgCl_2
- D. Al_2O_3

12. What is the correct Lewis structure for methanal?



13. Which of the following molecules is polar?



14. What type(s) of intermolecular forces is/are present in CH_3OCH_3 ?

A. dipole-dipole, hydrogen bonds and van der Waals'

B. dipole-dipole and van der Waals' only

C. hydrogen bonds and van der Waals' only

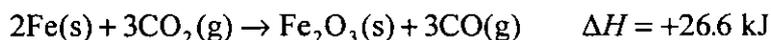
D. van der Waals' only

15. What changes occur when ice at its melting point is converted to liquid water?

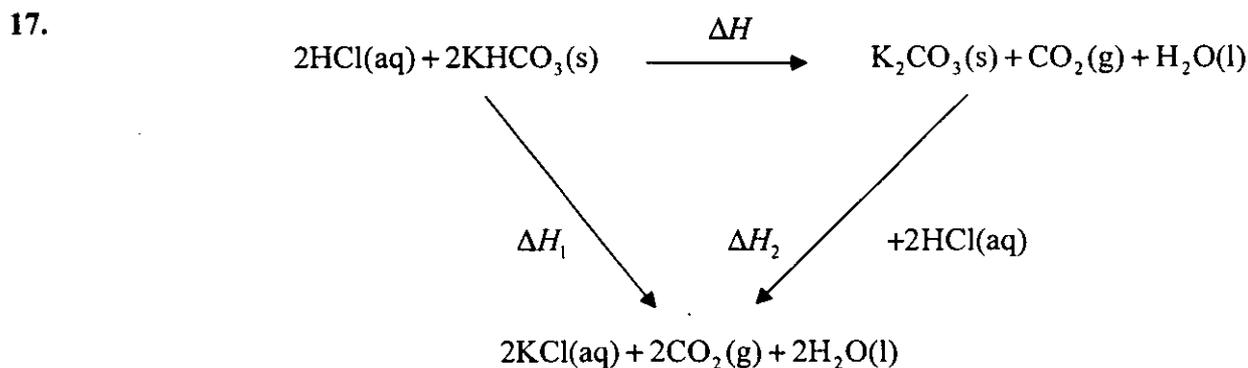
- I. movement of the molecules increases
- II. distance between molecules increases

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

16. Which statement about this reaction is correct?



- A. 26.6 kJ of energy are released for every mole of Fe reacted
- B. 26.6 kJ of energy are absorbed for every mole of Fe reacted
- C. 53.2 kJ of energy are released for every mole of Fe reacted
- D. 13.3 kJ of energy are absorbed for every mole of Fe reacted



This cycle may be used to determine ΔH for the decomposition of potassium hydrogencarbonate. Which expression can be used to calculate ΔH ?

- A. $\Delta H = \Delta H_1 + \Delta H_2$
- B. $\Delta H = \Delta H_1 - \Delta H_2$
- C. $\Delta H = \frac{1}{2}\Delta H_1 - \Delta H_2$
- D. $\Delta H = \Delta H_2 - \Delta H_1$

18. A sodium hydroxide solution is reacted with excess hydrochloric acid. What information is **not** needed to calculate the molar heat of neutralisation of sodium hydroxide?
- A. The initial temperature of both solutions
 - B. The volumes of both solutions
 - C. The concentration of the hydrochloric acid solution
 - D. The maximum temperature of the mixture
19. The rate of reaction of a strip of magnesium and 50 cm³ of 1 mol dm⁻³ HCl is determined at 25° C. In which case would **both** new conditions contribute to an increase in the rate of reaction?
- A. Mg powder and 100 cm³ of 1 mol dm⁻³ HCl
 - B. Mg powder and 50 cm³ of 0.8 mol dm⁻³ HCl
 - C. 100 cm³ of 1 mol dm⁻³ HCl at 30° C
 - D. 50 cm³ of 1.2 mol dm⁻³ HCl at 30° C
20. Which factor(s) will influence the rate of the reaction shown below?
- $$\text{NO}_2(\text{g}) + \text{CO}(\text{g}) \rightarrow \text{NO}(\text{g}) + \text{CO}_2(\text{g})$$
- I. The number of collisions per second
 - II. The energy of the collisions
 - III. The geometry with which the molecules collide
- A. I only
 - B. II only
 - C. I and II only
 - D. I, II and III

21. Chemical equilibrium is referred to as **dynamic** because, at equilibrium, the

- A. equilibrium constant changes.
- B. reactants and products keep reacting.
- C. rates of the forward and backward reactions change.
- D. concentrations of the reactants and products continue to change.

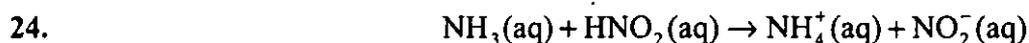
22. For this system at equilibrium, which change will shift the equilibrium to the right?



- A. Adding a catalyst
- B. Increasing the pressure
- C. Removing water
- D. Increasing the temperature

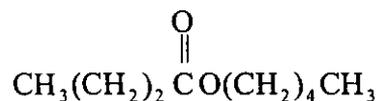
23. Which procedure can be used to distinguish between two unlabelled solutions of 1 mol dm^{-3} nitric acid and 1 mol dm^{-3} ethanoic acid?

- I. Measuring the electrical conductivity
 - II. Adding an acid–base indicator
- A. I only
 - B. II only
 - C. Both I and II
 - D. Neither I nor II



For this reaction, a Brønsted-Lowry acid is

- A. $\text{NH}_3(\text{aq})$ because it contains the largest number of hydrogen atoms.
 - B. $\text{NH}_3(\text{aq})$ because it accepts a proton from $\text{HNO}_2(\text{aq})$.
 - C. $\text{HNO}_2(\text{aq})$ because it has lone pairs of electrons on the oxygen atoms.
 - D. $\text{HNO}_2(\text{aq})$ because it donates a proton to $\text{NH}_3(\text{aq})$.
25. For which conversion is an oxidising agent required?
- A. $\text{Cl}^-(\text{aq}) \rightarrow \text{OCl}^-(\text{aq})$
 - B. $\text{SO}_3(\text{g}) \rightarrow \text{SO}_4^{2-}(\text{aq})$
 - C. $2\text{H}^+(\text{aq}) \rightarrow \text{H}_2(\text{g})$
 - D. $\text{S}_4\text{O}_6^{2-}(\text{aq}) \rightarrow 2\text{S}_2\text{O}_3^{2-}(\text{aq})$
26. The substance obtained at the cathode of an electrolytic cell has undergone
- A. oxidation by losing electrons.
 - B. oxidation by gaining electrons.
 - C. reduction by losing electrons.
 - D. reduction by gaining electrons.
27. From which two chemicals could this compound be most readily synthesized?



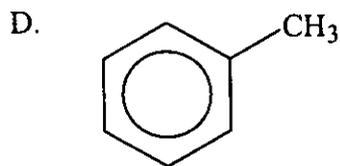
- A. butanoic acid and pentan-1-ol
- B. butanoic acid and butan-1-ol
- C. butanal and pentan-1-ol
- D. pentanoic acid and butan-1-ol

28. Ethanoic acid, CH_3COOH , and methyl methanoate, HCOOCH_3 , are classified as isomers because

- A. the two molecules have different molar masses.
- B. both molecules react with water.
- C. they can be distinguished with a polarimeter.
- D. the structures of the two molecules are different.

29. Which chemical is most likely to be a starting material for a common polymer?

- A. $\text{CH}_3\text{CH}_2\text{CH}_3$
- B. $\text{CH}_3\text{CH}_2\text{OH}$
- C. CH_3CHCH_2



30. What is the final product formed when ethanol, $\text{CH}_3\text{CH}_2\text{OH}$, is reacted with acidified potassium dichromate(VI)?

- A. ethanal
 - B. ethane
 - C. ethanoic acid
 - D. ethene
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