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IB · DP · Chemistry

🕐 30 mins   ❓ 30 questions

Practice Paper 1

Total Marks   **/30**

1 Which of these processes are endothermic?

I. Condensing

II. Subliming

III. Melting

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

(1 mark)

2 Ethanoic acid has the formula CH_3COOH. How many carbon atoms are present in 0.1 mol of ethanoic acid?

A. 6.0×10^{22}

B. 1.2×10^{23}

C. 6.0×10^{23}

D. 1.2×10^{24}

(1 mark)

3 *A periodic table is needed for this question*

Excess aqueous cold sodium hydroxide is reacted with 0.10 mol of chlorine gas, Cl2. One of the products is a compound of sodium, oxygen and chlorine.

What mass of the product is formed?

  A. 3.54 g

  B. 7.44 g

  C. 14.8 g

  D. 26.6 g

(1 mark)

4 *A periodic table is needed for this question*

Chicken eggs are made up of 5% by mass of egg shell. The average egg has a mass of 50 g.

Assume that chicken eggshell is pure calcium carbonate.

How many complete chicken's egg shells would need to neutralise 50 cm^3 of 2.0 mol dm^{-3} ethanoic acid?

  A. 4

  B. 3

  C. 2

  D. 1

(1 mark)

5 The phosphide ion, $^{32}_{15}P^{3-}$, is used in medicine as a radiotherapy treatment for some forms of cancer.

What is the composition of the phosphide ion?

	protons	neutrons	electrons
A	15	17	32
B	15	17	18
C	17	15	15
D	17	15	32

A.

B.

(1 mark)

6 Which statements correctly describe the distribution of mass and charge in the atom?

    1   the negative charge is concentrated in one area outside the nucleus

    2   the mass is concentrated inside the nucleus

    3   the negative charge is spread around outside the nucleus

A. 1 and 3

B. 1 and 2

C. 2 and 3

D. 1, 2 and 3

(1 mark)

7 Which of the following statements describes first ionisation energy?

    A. The energy required to remove one mole of electrons from one mole of gaseous atoms

    B. The energy required to remove the outermost electron from each atom in one mole of gaseous atoms

    C. The energy required to remove the outermost electron from each atom in one mole of atoms

    D. The energy required to produce one mole of ions from one mole of gaseous atoms

(1 mark)

8 The electronegativity of four elements are given below

$$N = 3.0 \qquad H = 2.1 \qquad F = 4.0 \qquad P = 2.1$$

What is the correct order of polarity for the following compounds

    A. $PH_3 < PF_3 < NF_3 < NH_3$

    B. $PH_3 < PF_3 < NH_3 < NF_3$

    C. $NF_3 < NH_3 < PH_3 < PF_3$

    D. $PH_3 < NH_3 < NF_3 < PF_3$

(1 mark)

9 Which of the species shown below does **not** have resonance structures?

    A. C_6H_6

    B. CO_3^{2-}

    C. C_2H_4

    D. O_3

(1 mark)

10 What is the strongest type of intermolecular force exhibited in the amino acid molecule serine?
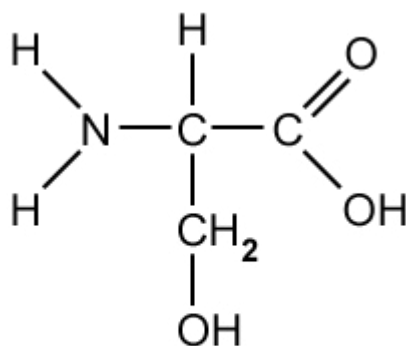
Serine

A. London dispersion forces

B. Permanent dipole permanent dipole forces

C. Hydrogen bonding

D. Covalent bonding

(1 mark)

11 Which of the following molecules will have the highest boiling point?

A. CH_3CH_2CHO

B. $CH_3CH_2CH_2NH_2$

C. $CH_3CH_2OCH_3$

D. $CH_3CH_2CH_2F$

(1 mark)

12 An experiment was carried out to determine the approximate value for the molar enthalpy change of neutralisation.

75 cm^3 of 3.00 mol dm^{-3} hydrochloric acid was placed in a polystyrene beaker of negligible heat capacity. Its temperature was recorded, and then 75 cm^3 of 3.00 mol dm^{-3} potassium hydroxide at the same temperature was quickly added, and the solution stirred.

The temperature rose by 14 °C. The resulting solution may be considered to have a specific heat capacity of 4.18 J g^{-1} K^{-1}.

Which calculation below is correct?

A. $-\dfrac{(75 \; \times \; 4.18 \; \times \; 14)}{(6.0 \times 0.150)}$ J mol^{-1}

B. $-\dfrac{(150 \; \times \; 4.18 \; \times \; 14)}{(3.0 \; \times 0.075)}$ J mol^{-1}

C. $-\dfrac{(150 \; \times \; 4.18 \; \times \; 14)}{(3.0 \; \times 75.0)}$ J mol^{-1}

D. $-\dfrac{(75 \; \times \; 4.18 \; \times \; 287)}{(6.0 \times \; 0.150)}$ J mol^{-1}

(1 mark)

13 The equations below show the formation of sulfur oxides from sulfur and oxygen.

S(s) + O$_2$(g) → SO$_2$(g)　　　　　$\Delta H_f^{\ominus}$ = –297 kJ mol^{-1}

S(s) + 1½O$_2$(g) →SO$_3$(g)　　　　　$\Delta H_f^{\ominus}$ = –395 kJ mol^{-1}

What is the enthalpy change of reaction, $\Delta H^{\ominus}$, of 2SO$_2$(g) + O$_2$(g) → 2SO$_3$(g) in kJ mol^{-1}?
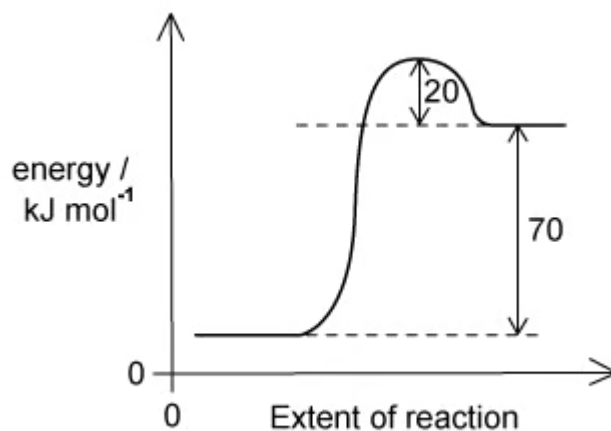
A. (794 − 594)

B. (296 + 395)

C. (− 395 + 297)

D. (−790 + 594)

(1 mark)

14 The reaction pathway for a reversible reaction is shown below:

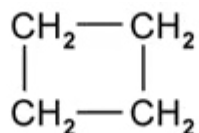Which statement is correct?

   A. The activation energy of the reverse reaction is +90 kJ mol⁻¹

   B. The activation energy of the forward reaction is +20 kJ mol⁻¹

   C. The activation of the reverse reaction is +20 kJ mol⁻¹

   D. The enthalpy change of forwards reaction is - 70 kJ mol⁻¹

(1 mark)

15 The diagram shows the skeletal formula of cyclobutane.

The enthalpy change of formation of cyclobutane is +75.1 kJ mol⁻¹, and the enthalpy change of atomisation of graphite is +712 kJ mol⁻¹.

The bond enthalpy of C–H is 414 kJ mol⁻¹ and of H–H is 436 kJ mol⁻¹.

What is the average bond enthalpy of the C–C bond in cyclobutane?

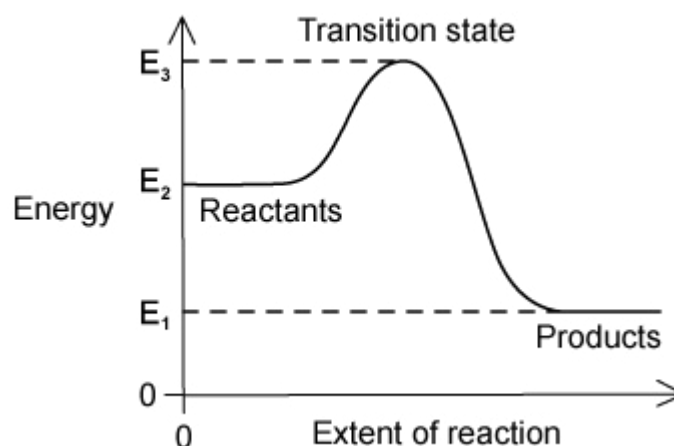**A.** $712 - 436 + 2(414) + \dfrac{75.1}{4}$

B. $712 + 436 - 414 - \dfrac{75.1}{4}$

C. $712 + 436 - 2(414) - \dfrac{75.1}{4}$

D. $712 + 436 - 2(414) - 75.1$

(1 mark)

16 The energies of the reactants, the products and the transition state of a reaction are shown in the reaction pathway diagram below.

Which expression correctly represents how to calculate the activation energy of the forward reaction?

**A.** $E_1 - E_2$

B. $E_2 - E_1$

C. $E_2 - E_3$

D. $E_3 - E_2$

(1 mark)

17 Bleach solution contains sodium chlorate (I) which naturally decomposes according to the equation below:

$$2NaClO \text{ (aq)} \rightarrow 2NaCl \text{ (aq)} + O_2 \text{ (g)}$$

The bleach decomposes faster as the temperature increases. A 100 cm^3 sample of 10% bleach was heated to 40 $°$C and the amount of oxygen evolved was measured against time.

The experiment was repeated under the same conditions, but this time using a 100 cm^3 sample of 20% bleach. If the first experiment produces the dotted line, which line is produced by the second experiment?
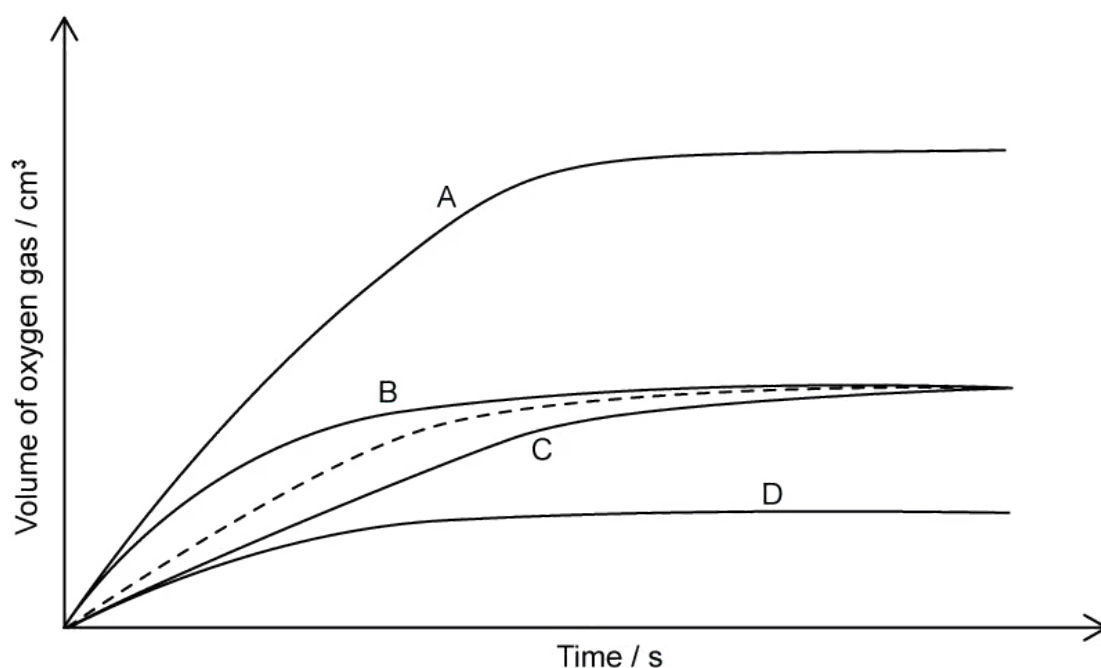
(1 mark)

18 The dissociation of gas X_2Y_4 into XY_2 is represented in the equation below:

$$X_2Y_4 \text{ (g)} \rightleftharpoons 2XY_2 \text{ (g)} \qquad \Delta H^{\varnothing} = +60 \text{ kJ mol}^{-1}$$

At constant pressure, if the temperature of the equilibrium mixture of the gases is increased, will the volume of the mixture increase or decrease and why?

A. the volume will increase, but only because of a shift of equilibrium towards the right

B. the volume will increase, both because of a shift of equilibrium towards the right and also because of thermal expansion

C. the volume will stay the same because any thermal expansion could be exactly counteracted by a shift of equilibrium towards the left

D. the volume will decrease because a shift of equilibrium towards the left would more than counteract any thermal expansion

(1 mark)

19 The following K_c values were obtained for a reaction carried out at different temperatures, T_1 to T_4.

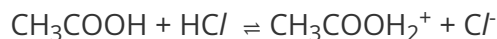| Temperature	K_c value
T_1	1×10^{-2}
T_2	1×10^{1}
T_3	1
T_4	1×10^{2}

Which of the following gives the correct amount of products in the mixtures from least to most?

A. $T_1 < T_2 < T_3 < T_4$

B. $T_4 < T_3 < T_2 < T_1$

C. $T_4 < T_2 < T_3 < T_1$

D. $T_1 < T_3 < T_2 < T_4$

(1 mark)

20 What role does each species play in the equilibrium below according to Brønsted-Lowry theory?

$$CH_3COOH + HCl \rightleftharpoons CH_3COOH_2^+ + Cl^-$$

	CH_3COOH	HCl	$CH_3COOH_2^+$	Cl^-
A	acid	base	base	acid
B	acid	base	acid	base
C	base	acid	base	acid
D	base	acid	acid	base

(1 mark)

21 Four 1.0 M solutions of HCl, NH_3, NaOH and CH_3COOH have been mislabelled, but a student has a pH meter to test the pH of the solutions. Arrange the solutions in order of increasing pH:

   A. HCl (aq) < NH_3 (aq) < NaOH (aq) < CH_3COOH (aq)

   B. CH_3COOH (aq) < HCl (aq) < NH_3 (aq) < NaOH (aq)

   C. HCl (aq) < CH_3COOH (aq) < NH_3 (aq) < NaOH (aq)

   D. NaOH (aq) < NH_3 (aq) < CH_3COOH (aq) < HCl (aq)

(1 mark)

22 The pH of clean rain water is around 5.5. Which substance is responsible for this?

   A. Methane

   B. Carbon dioxide

   C. Nitrogen oxides

   D. Sulfur dioxide

(1 mark)

23 Which row correctly describes oxidation and reduction in terms of the transfer of electrons and changes in oxidation state?

	Transfer of electrons		Change in oxidation state	
	oxidation	reduction	oxidation	reduction
A	gain	loss	increase	decrease
B	loss	gain	increase	decrease
C	loss	gain	decrease	increase
D	gain	loss	decrease	increase

(1 mark)

24 What is formed at the electrodes during the electrolysis of molten potassium iodide?

	Positive electrode	Negative electrode
A	K^+	I^-
B	K	I_2
C	I^-	K^+
D	I_2	K

(1 mark)

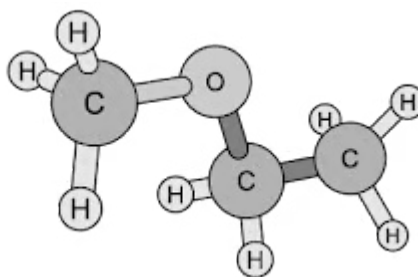**25** Which features about the members of a homologous series are correct?

     I. all members have the same general formula
    II. the members have similar chemical properties
   III. the members show a gradual change in physical properties

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

(1 mark)

26 What is the correct IUPAC name for the molecule shown?

A. ethoxyethane

B. methoxyethane

C. propanone

D. propanal

(1 mark)

27 In the hydrolysis of bromoethane by aqueous sodium hydroxide, what is the nature of the attacking group and of the leaving group?

	attacking group	**leaving group**
A	electrophile	electrophile
B	electrophile	nucleophile
C	nucleophile	electrophile
D	nucleophile	nucleophile

(1 mark)

28 *A periodic table is needed for this question*

Which compound has an M_r of 84.18 and will react with HBr to give a product with an M_r of 165.09?
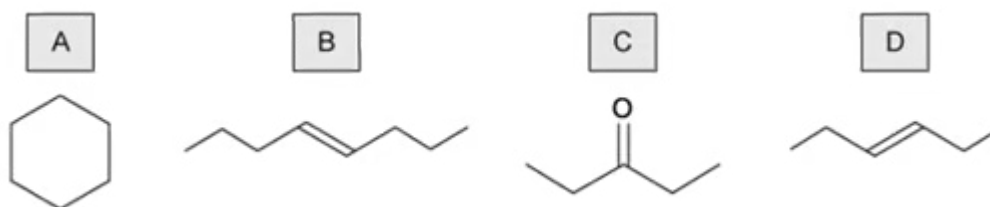
(1 mark)

29 Bromine exists as two isotopes ^{79}Br and ^{81}Br, which are found in almost equal abundance.

Which of the following statements is correct?

  A. ^{79}Br is more reactive than ^{81}Br

  B. The mass spectrum of C_3H_7Br has two molecular ion peaks at 122 and 124

  C. The atomic radius of ^{79}Br is less than the atomic radius of ^{81}Br

  D. The first ionisation energy of ^{79}Br is less than the first ionisation energy of ^{81}Br

(1 mark)

30 Which alcohol is likely to have a fragment ion at *m/e* = 31 in its mass spectrum?

A. $(CH_3)_2CHCH_2OH$

B. $CH_3CH(OH)CH_2CH_2CH_3$

C. $CH_3CH_2CH_2C(OH)(CH_3)_2$

D. $CH_3CH_2CH(OH)CH_3$

(1 mark)