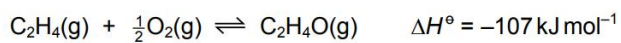


AS MOCK EXAM

- 1 Ethene can be oxidised to form epoxyethane, C_2H_4O .



Which set of conditions gives the greatest yield of epoxyethane at equilibrium?

	pressure	temperature / °C
A	high	100
B	high	200
C	low	100
D	low	200

- 2 Cobalt can form the positive ion $Co(NH_3)_4Cl_2^+$.

What is the oxidation number of cobalt in this ion?

- A +1 B +2 C +3 D +6

- 3 When considering one molecule of ethene, which row describes both the hybridisation of the atomic orbitals in the carbon atoms and the overall bonding?

	hybridisation	bonding
A	sp^2	4 σ bonds 1 π bond
B	sp^2	5 σ bonds 1 π bond
C	sp^3	4 σ bonds 1 π bond
D	sp^3	5 σ bonds 1 π bond

- 4 Which atom has more unpaired electrons than paired electrons in orbitals of principal quantum number 2?

- A carbon
B nitrogen
C oxygen
D fluorine

- 5 Atom X is the central atom in a molecule.

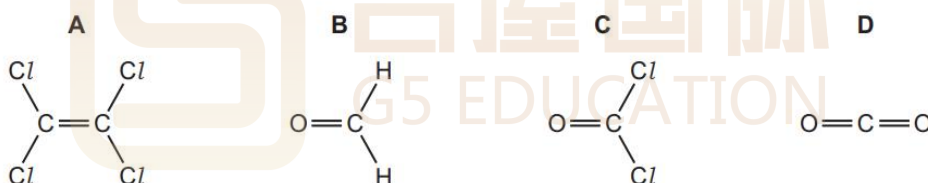
In this molecule, atom X has four pairs of valence electrons in its outer shell.

The four pairs of valence electrons include at least one bond pair and at least one lone pair.

What could be a possible shape for the molecule?

- A linear
- B non-linear
- C trigonal bipyramidal
- D trigonal planar

- 6 Which molecule has the largest overall dipole?



- 7 The strength of hydrogen bonding increases as the electronegativity of the element bonded to hydrogen increases.

Some information for a range of hydrides is given.

hydride	boiling point /K
PH ₃	185
HCl	188
HF	293
H ₂ O	373

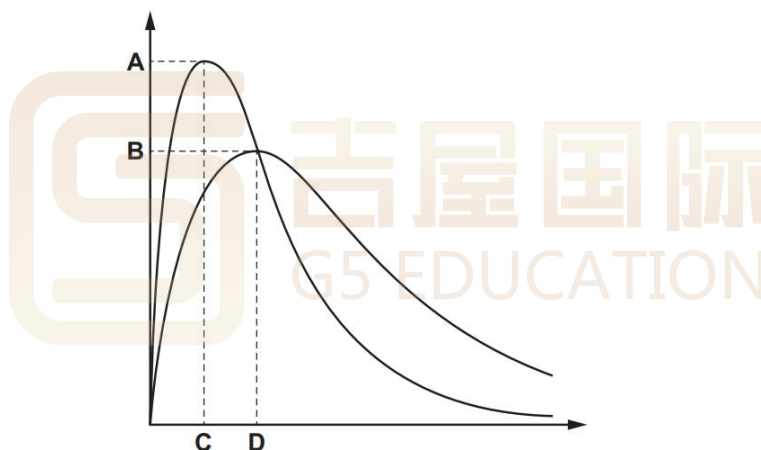
Which statement and reason about these hydrides is correct?

- A The boiling point of PH₃ is much lower than the boiling point of H₂O because PH₃ does not form hydrogen bonds or instantaneous dipole-induced dipole forces between its molecules.
- B The boiling point of HF is higher than the boiling point of HCl because the bond energy of H-F is greater than the bond energy of H-Cl.
- C The boiling point of H₂O is higher than the boiling point of HF because each hydrogen bond between the H₂O molecules is stronger than each hydrogen bond between HF molecules.
- D The boiling points of PH₃ and HCl are similar because the molecules of PH₃ and HCl have the same number of electrons and similar intermolecular forces.

8

The diagram shows the Boltzmann energy distribution curves for molecules of a sample of a gas at two different temperatures.

Which letter on the axes represents the most probable energy for molecules of the same sample of gas at the **lower** temperature?



9.

The general gas equation can be used to calculate the value of the M_r of a gas.

For a sample of a gas of mass m grams, which expression will give the value of M_r ?

- A** $M_r = \frac{mRT}{pV}$
 B $M_r = \frac{pVRT}{m}$
 C $M_r = \frac{mpV}{RT}$
 D $M_r = \frac{pV}{mRT}$

10.

In this question you should use changes in oxidation numbers to balance a chemical equation.

Acidified potassium dichromate(VI) solution can oxidise a solution of V^{2+} ions. The equation for this reaction is shown.



What is the ratio $a : b$ in the correctly balanced equation?

- A** 1 : 1
 B 1 : 2
 C 2 : 1
 D 4 : 1

11.

A sample of argon gas has a mass of 0.20 g, at a pressure of 100 000 Pa and a temperature of 12°C.

Which volume does the gas occupy?

- A $1.2 \times 10^{-4} \text{ cm}^3$
- B 5.0 cm^3
- C 59 cm^3
- D 119 cm^3

12.

A sample of solid ammonium chloride decomposes on heating.

solid ammonium chloride \rightarrow ammonia gas + hydrogen chloride gas

A total of 2.4×10^{21} molecules of gas is formed.

How many hydrogen atoms are present in the gaseous products?

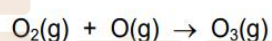
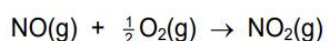
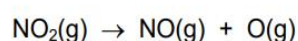
- A 1.2×10^{21} B 2.4×10^{21} C 4.8×10^{21} D 9.6×10^{21}

13.

NO and NO₂ are both present in the lower atmosphere as pollutants.

The reaction sequence shows the production of ozone from oxygen in the lower atmosphere.

This sequence repeats many times.



Which statement about this reaction sequence is correct?

- A NO is acting as a catalyst, but NO₂ is not acting as a catalyst.
- B NO₂ is acting as a catalyst, but NO is not acting as a catalyst.
- C Neither NO nor NO₂ are acting as catalysts.
- D Both NO and NO₂ are acting as catalysts.

14.

A white powder is known to be a mixture of magnesium oxide and aluminium oxide.

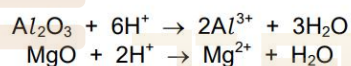
100 cm³ of 2 mol dm⁻³ NaOH(aq) is just enough to dissolve the aluminium oxide in x grams of the mixture.

The reaction is shown.



800 cm³ of 2 mol dm⁻³ HCl(aq) is just enough to dissolve **all** of the oxide in x grams of the mixture.

The reactions are shown.

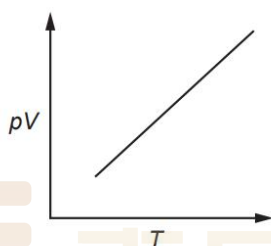


How many moles of each oxide are present in x grams of the mixture?

	aluminium oxide	magnesium oxide
A	0.05	0.25
B	0.05	0.50
C	0.10	0.25
D	0.10	0.50

15.

A graph of pV against T is shown for a fixed mass of gas. (p = pressure, V = volume and T = temperature in K.)



Which gas gives this graph over the widest range of temperatures and pressures?

- A** hydrogen, H₂
- B** hydrogen chloride, HCl
- C** hydrogen fluoride, HF
- D** oxygen, O₂

16.

A weather balloon is filled with 12.0 kg helium. The weather balloon reaches a height of 20 km, the pressure inside the balloon is 6000 Pa and the temperature is 216 K.

What is the volume of the weather balloon at this height, correct to three significant figures?

- A** 897 dm³
- B** 1790 dm³
- C** 897 000 dm³
- D** 1 790 000 dm³

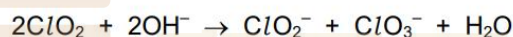
17.

Which pair of enthalpy changes will **always** share the same sign (i.e. both are always exothermic or both are always endothermic)?

- A enthalpy change of atomisation and enthalpy change of neutralisation
- B enthalpy change of atomisation and enthalpy change of solution
- C enthalpy change of combustion and enthalpy change of hydration
- D enthalpy change of solution and enthalpy change of hydration

18.

Chlorine dioxide, ClO_2 , reacts with sodium hydroxide in the reaction shown.

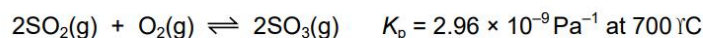


Which statement correctly describes this redox reaction?

- A Chlorine atoms are oxidised and oxygen atoms are reduced.
- B Chlorine atoms are reduced and oxygen atoms are oxidised.
- C Some chlorine atoms are oxidised and some chlorine atoms are reduced.
- D Some oxygen atoms are oxidised and some oxygen atoms are reduced.

19.

Sulfur dioxide and oxygen react to form sulfur trioxide. The reaction is reversible.



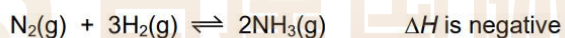
The reaction is allowed to reach equilibrium at 700°C . The partial pressure of $\text{O}_2(\text{g})$ is 375 kPa and the partial pressure of $\text{SO}_3(\text{g})$ is 20.3 kPa.

What is the partial pressure of $\text{SO}_2(\text{g})$?

- A 19.3 kPa B 609 kPa C 18 300 kPa D 609 000 kPa

20.

Ammonia is made by the Haber process. The reactants are nitrogen and hydrogen.



What will increase the rate of the forward reaction?

- A adding argon to the mixture but keeping the total volume constant
- B decreasing the temperature
- C increasing the total pressure by reducing the total volume at constant temperature
- D removing ammonia as it is made but keeping the total volume of the mixture the same

ANSWER:

1-5 ACBBB 6-10BDAAB 11-15 DCBDA 16-20 C CCBC

