IB DP CHEMISTRY EXAM

Q125

What is thin-layer chromatography best used for separating?

A. molecules of varying polarity

B. molecules of similar polarity

C. metals in an alloy

D. water of crystallization from hydrated salts

Q325

The table lists successive ionization energies of an element **Z**.

Ionization number	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**
Ionization energy / kJ mol^{-1}	577.54	1816.68	2744.78	11577.5	14841.9	18379.0

Which is the formula of the stable oxide of the element **Z**?

A. Z_2O

B. ZO

C. Z_2O_3

D. ZO_2

Q425

A container holds 30 g of argon and 60 g of neon.

What is the ratio of number of atoms of argon to number of atoms of neon in the container?

A. 0.25

B. 0.50

C. 2.0

D. 4.0

Q625

What is the formula of the compound formed between magnesium ions and hydrogencarbonate ions?

A. $MgHCO_3$

B. $Mg(HCO_3)_2$

C. $Mg(HCO_3)_3$

D. $Mg_3(HCO_3)_2$

Q825

What is the molecular geometry of the central atom in SF_4Cl_2?

A. linear

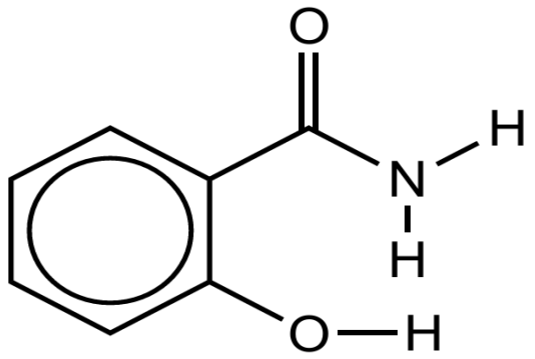
B. tetrahedral

C. hexagonal

D. octahedral

Q1025

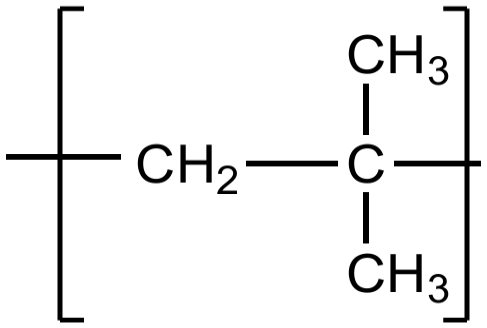
Which pair of statements about electrons in this molecule is correct?



	Number of non-bonding pairs of electrons	Number of electrons in π bonds
A.	3	6
B.	3	8
C.	5	6
D.	5	8

Q1225

The structure shows the repeating unit of a polymer found in some plastics.



Which monomer is used to form this plastic?

A. $H_2C{=}C(CH_3)_2$

B. $CH_3CH(CH_3)_2$

C. $(H_3C)_2C{=}C(CH_3)_2$

D. $(H_3C)_2C{=}CHCH(CH_3)_2$

Q1525

The block structure of the periodic table groups elements according to which characteristic?

A. atomic number

B. atomic mass

C. electron configuration

D. reactivity

Q2125

What is the enthalpy change for the reaction in $kJ\,mol^{-1}$?

$$CO_2(g) + H_2(g) \rightarrow CO(g) + H_2O(g)$$

$2CO(g) + O_2(g) \rightarrow 2CO_2(g)$ $\quad \Delta H = -566\,kJ\,mol^{-1}$

$2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$ $\quad \Delta H = -572\,kJ\,mol^{-1}$

$H_2O(g) \rightarrow H_2O(l)$ $\quad \Delta H = -44\,kJ\,mol^{-1}$

A. -1182

B. -899

C. -41

D. $+41$

Q2325

Which are endothermic processes in a Born–Haber cycle for the formation of an ionic compound?

I. Enthalpy of atomization

II. First electron affinity

III. First ionization energy

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

Q2525

The complete combustion of 20.0 cm^3 of a gaseous hydrocarbon, C_xH_y, produces 80.0 cm^3 of gaseous products. This volume reduces to 40.0 cm^3 when the water vapour present condenses. All volumes are measured at the same temperature and pressure.

What is the molecular formula of the hydrocarbon?

A. CH_4

B. C_2H_2

C. C_2H_4

D. C_3H_6

Q2825

What is the equilibrium constant expression for the following reaction?

$$2SO_3(g) \rightleftharpoons 2SO_2(g) + O_2(g)$$

A. $\dfrac{[SO_2]^2[O_2]}{[SO_3]^2}$

B. $\dfrac{[SO_2]^2 + [O_2]}{[SO_3]^2}$

C. $\dfrac{[SO_3]^2}{[SO_2]^2[O_2]}$

D. $\dfrac{2[SO_2][O_2]}{2[SO_3]}$

Q3025

The equation for the reaction between two gases, A and B, is:

$$A(g) + 2B(g) \rightleftharpoons 2C(g)$$

When the reaction is at equilibrium at 600 K, the concentrations of A, B, and C are 2, 1, and 2 $mol\,dm^{-3}$ respectively. What is the value of the equilibrium constant at 600 K?

A. 0.25

B. 1

C. 2

D. 4

Q3225

Which reactions involve the transfer of a proton?

I. $2HCl(aq) + Mg(s) \rightarrow MgCl_2(aq) + H_2(g)$

II. $2HCl(aq) + MgO(s) \rightarrow MgCl_2(aq) + H_2O(l)$

III. $2HCl(aq) + MgCO_3(s) \rightarrow MgCl_2(aq) + H_2O(l) + CO_2(g)$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

Q3425

The overall reaction occurring at the electrodes of a rechargeable metal hydride battery can be summarized as:

$$MH + NiO(OH) \rightleftharpoons M + Ni(OH)_2$$

Which statement is correct?

A. The oxidation state of Ni does not change.

B. M is oxidized by loss of hydrogen.

C. The oxidation state of one H atom changes from -1 to $+1$.

D. The oxidation state of one O atom changes from -1 to -2.

Q3625

Which statements explain the following reactions occurring in the upper atmosphere?

	Chlorofluorocarbon (CFC) compounds break down to produce chlorine radicals but usually not fluorine radicals.	**A single chlorine radical breaks down many ozone, O_3, molecules.**
A.	C–Cl bond is stronger than C–F bond	chain propagation steps produce more radicals
B.	C–F bond is stronger than C–Cl bond	chain termination steps cause chlorine radicals to reform chlorine molecules
C.	C–Cl bond is stronger than C–F bond	chain termination steps cause chlorine radicals to reform chlorine molecules
D.	C–F bond is stronger than C–Cl bond	chain propagation steps produce more radicals

Q225

Ice containing only the isotope ^{2}H sinks and does not melt when dropped into ordinary distilled water maintained at 3 °C.

Which statement is correct?

A. The isotope ^{2}H has a high natural abundance.

B. $^{2}H_2O$ (s) has a higher melting point than normal ice.

C. $^{2}H_2O$ (s) has a lower density than normal ice-cold water.

D. $^{2}H_2O$ has different chemical properties from normal water.

Q325

Which electron transition in the hydrogen atom emits radiation with the highest energy?

A. $n = 1$ to $n = 2$

B. $n = 2$ to $n = 3$

C. $n = 2$ to $n = 1$

D. $n = 3$ to $n = 2$

Q825

Which properties depend on the movement of the delocalized electrons in a metal?

I. Electrical conductivity

II. Thermal conductivity

III. Density

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

Q925

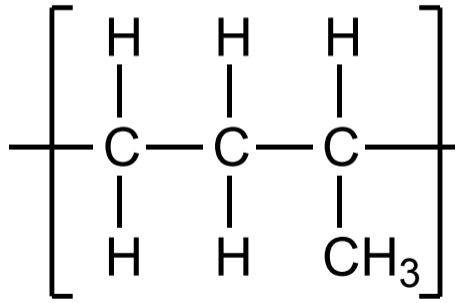
Which substance, made from two elements with electronegativities E_X and E_Y, is an alloy?

	Average electronegativity $\frac{E_X + E_Y}{2}$	**Electronegativity difference** $E_X - E_Y$
A.	2.5	2.5
B.	2.5	1.0
C.	3.5	0.2
D.	1.2	0.2

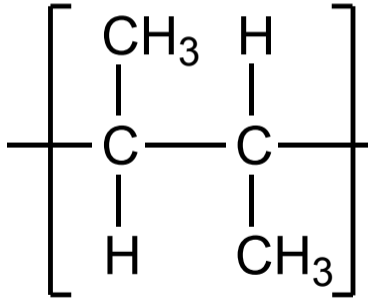
Q1025

10. Which structure shows the repeating unit of the polymer formed by but-1-ene?

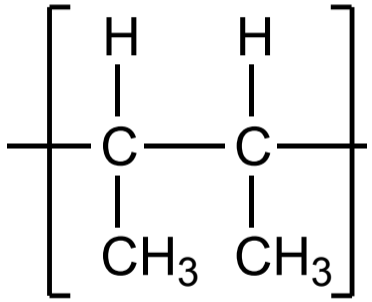
A.



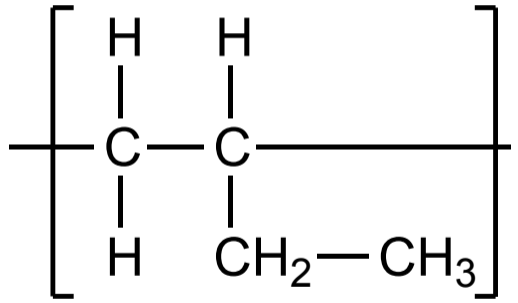
C.



B.

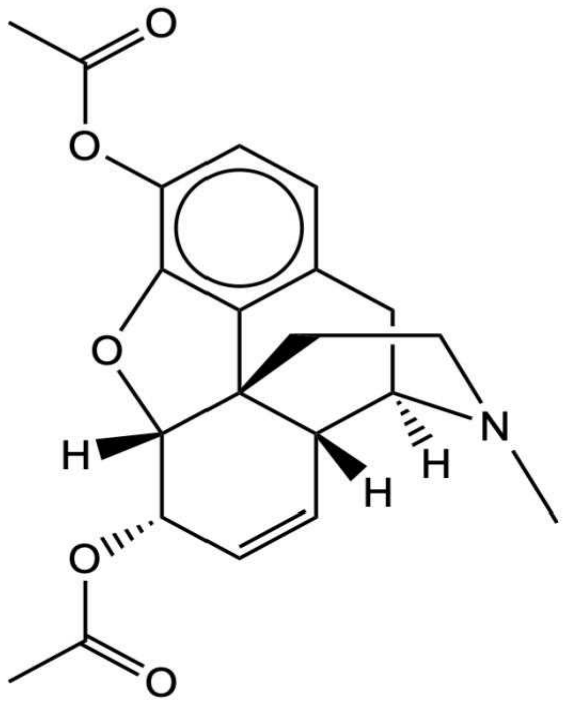


D.



Q1225

Which functional groups are present in this molecule?



A. amino, alkoxy, ester

B. ether, carboxyl, amino

C. carboxyl, alkoxy, ester

D. ester, amino, carboxyl

Q1725

Which enthalpy changes can be calculated using only bond enthalpy data?

I. $N_2(g) + 2H_2(g) \rightarrow N_2H_4(g)$

II. $CH_4(g) + 2O_2(g) \rightarrow 2H_2O(l) + CO_2(g)$

III. $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

Q1925

What is the amount, in mol, of H_2O produced for a reaction between 10.0 mol of C_2H_3Cl and 10.0 mol of O_2 if the yield is 90 %?

$$2C_2H_3Cl\,(g) + 5O_2\,(g) \rightarrow 4CO_2\,(g) + 2H_2O\,(g) + 2HCl\,(g)$$

A. 3.60

B. 4.00

C. 9.00

D. 10.00

Q2625

The overall reaction occurring at the electrodes of a rechargeable metal hydride battery can be summarized as:

$$MH + NiO(OH) \rightleftharpoons M + Ni(OH)_2$$

Which statement is correct?

A. The oxidation state of Ni does not change.

B. M is oxidized by loss of hydrogen.

C. The oxidation state of one H atom changes from –1 to +1.

D. The oxidation state of one O atom changes from –1 to –2.

Q2725

In a redox titration, manganate(VII) ions are reduced to manganese(II) ions and iron(II) ions are oxidized to iron(III) ions.

$MnO_4^-(aq)$ reduced to $Mn^{2+}(aq)$

$Fe^{2+}(aq)$ oxidized to $Fe^{3+}(aq)$

What volume, in cm^3, of $0.1\,mol\,dm^{-3}$ $MnO_4^-(aq)$ is required to reach the equivalence point in the titration of $20.00\,cm^3$ of $0.1\,mol\,dm^{-3}$ $Fe^{2+}(aq)$?

A. 2.00

B. 4.00

C. 20.00

D. 100.00

Q2825

What is the organic product of the reaction of 1-chloropentane with aqueous sodium hydroxide?

A. pentan-1-ol

B. 1-chloropentan-1-ol

C. 1-chloropent-1-ene

D. 1-chloropent-2-ene

Q2925

Which statements explain the following reactions occurring in the upper atmosphere?

	Chlorofluorocarbon (CFC) compounds break down to produce chlorine radicals but usually not fluorine radicals.	**A single chlorine radical breaks down many ozone, O_3, molecules.**
A.	C–Cl bond is stronger than C–F bond	chain propagation steps produce more radicals
B.	C–F bond is stronger than C–Cl bond	chain termination steps cause chlorine radicals to reform chlorine molecules
C.	C–Cl bond is stronger than C–F bond	chain termination steps cause chlorine radicals to reform chlorine molecules
D.	C–F bond is stronger than C–Cl bond	chain propagation steps produce more radicals

Q3025

Which species can act as an electrophile?

A. CH_4

B. Cl_2

C. Cl^-

D. OH^-