Practice Paper 1

Question Paper

Course	DP IB Chemistry
Section	Set A
Topic	Practice Paper 1
Difficulty	Medium

Time allowed: 40

Score: /30

Percentage: /100

Question 1

A periodic table is needed for this question

A compound has an empirical formula of C_2H_6O and a molar mass of 92.16.
What is the molecular formula of this compound?

A C_2H_6O

B $C_4H_{12}O_2$

C $C_6H_{18}O_3$

D $C_8H_{24}O_4$

[1 mark]

Question 2

When lead sulfide reacts with oxygen it produces lead(II)oxide and sulfur dioxide according to the equation below:

$$PbS(s) + O_2(g) \rightarrow PbO(s) + SO_2(g)$$

What is the whole number sum of the coefficients in the balanced equation?

A 4

B 5

C 8

D 9

[1 mark]

Question 3

A compound is made of sulfur and oxygen only. A sample of the compound has a mass of 8.0g, and consists of 3.2g of sulfur and 4.8g of oxygen. The empirical formula of the compound is:
(RAMs S = 32.0, O = 16.0)

A SO

B SO_2

C SO_3

D S_2O_3

[1 mark]

Question 4

A sample of chlorine gas with a of mass 5.35 g has a volume of 1.247×10^{-3} m^3 at a pressure of 1.00×10^5 Pa.

Assuming that the gas acts as an ideal gas, what is the temperature of the gas in K?

A $\frac{5.35 \times 1.0 \times 1.247}{(70.90 \times 8.314)}$

B $\frac{5.35 \times (1.0 \times 10^5) \times (1.247 \times 10^{-3})}{(8.314)}$

C $\frac{5.35 \times (1.0 \times 10^5) \times (1.247 \times 10^{-3})}{(70.90 \times 8.314)}$

D $\frac{70.90 \times (1.0 \times 10^5) \times (1.247 \times 10^{-3})}{(5.35 \times 8.314)}$

[1 mark]

Question 5

A periodic table is needed for this question

In which of the following species are the numbers of protons, neutrons and electrons all different?

A $^{23}Na^+$ **B** ^{27}Al **C** $^{19}F^-$ **D** $^{32}S^{2-}$

[1 mark]

Question 6

The reaction shown occurs in gas clouds throughout the Universe.

$$H_2(g) + H_2^+(g) \rightarrow H(g) + H_3^+(g)$$

Which is the correct atomic structure of the H_3^+ ion?

	protons	neutrons	electrons
A	3	0	1
B	3	0	2
C	2	1	1
D	2	1	2

[1 mark]

Question 7

Electron configurations for atoms of different elements are shown below.

Which electron configuration represents the element with the largest first ionisation energy?

A. $1s^2 2s^2 2p^6 3s^2$

B. $1s^2 2s^2 2p^6 3s^2 3p^4$

C. $1s^2 2s^2 2p^6 3s^2 3p^6$

D. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$

[1 mark]

Question 8

Which of the following statements about 2–methylpropan-2–ol, $CH_3C(CH_3)(OH)CH_3$, are correct ?

I. The structure contains 16 bonding pair of electrons
II. The O-C-C bond angle is 109.5 °
III. The total number of electrons is 32

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

[1 mark]

Question 9

The following equation shows the dissociation equilibrium of PCl_5.

$$PCl_5(g) \rightarrow PCl_3(g) + Cl_2(g)$$

The percentage yield of PCl_3 varies with temperature.

At 160°C PCl_3 yield is 13% and at 300°C yield is100%.

Which of the following rows is correct?

	The reaction is	**Shape of PCl_3 molecule**
A	exothermic	trigonal pyramidal
B	exothermic	trigonal planar
C	endothermic	trigonal pyramidal
D	endothermic	trigonal planar

[1 mark]

Question 10

Which of the following metals would have the highest melting point?

A. Na

B. Mg

C. Al

D. K

[1 mark]

Question 11

The correct order of increasing boiling points for the following compounds is

A. 1-chlorobutane < butane < butan-1-ol

B. Butan-1-ol < 1-chlorobutane < butane,

C. Butane < 1-chlorobutane < butan-1-ol

D. Butan-1-ol < butane < 1-chlorobutane

[1 mark]

Question 12

Which equation below can represent both an enthalpy change of formation and combustion?

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

B. $2Na(s) + ½O_2(g) \rightarrow Na_2O(s)$

C. $HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$

D. $CO(g) + C(s) \rightarrow CO_2(g)$

[1 mark]

Question 13

Titanium occurs naturally as the mineral rutile, TiO_2. One possible method of extraction of titanium is to reduce the rutile by heating with carbon.

$$TiO_2(s) + 2C(s) \rightarrow Ti(s) + 2CO(g)$$

The standard enthalpy changes of formation of $TiO_2(s)$ and $CO(g)$ are $-890\ kJ\ mol^{-1}$ and $-110.5\ kJ\ mol^{-1}$ respectively.

What is the standard enthalpy change of the extraction of titanium?

A. $+669\ kJ\ mol^{-1}$

B. $+779.5\ kJ\ mol^{-1}$

C. $-779.5\ kJ\ mol^{-1}$

D. $-669\ kJ\ mol^{-1}$

[1 mark]

Question 14

In the gas phase, phosphorus pentachloride can be thermally decomposed into gaseous phosphorus trichloride and chlorine.

$$PCl_5 \rightarrow PCl_3 + Cl_2$$

The table below gives the relevant bond energies found in these compounds.

bond	bond energy / kJ mol^{-1}
P–Cl (in both chlorides)	x
Cl–Cl	y

What is the enthalpy change in the decomposition of the reaction?

A. $y - 2x$

B. $2x - y$

C. $8x + y$

D. $x + y$

[1 mark]

Question 15

The standard enthalpy change, $\Delta H^{\ominus}$, for the following reaction is -246 kJ.

$$N_2(g) + 3F_2(g) \rightarrow 2NF_3(g)$$

The bond energy of N≡N is 945 kJ mol^{-1} and F–F is 159 kJ mol^{-1}

What is the bond energy of the N–F bond?

A. $\frac{246 - (945 + (3 \times 159))}{6}$

B. $\frac{-246 + (945 + (3 \times 159))}{6}$

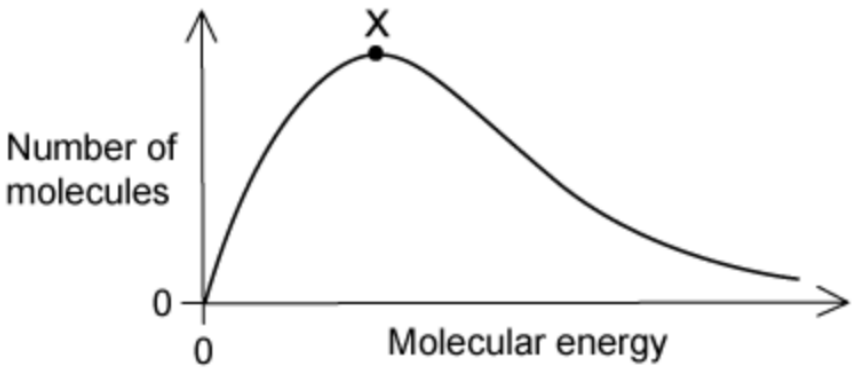
C. $\frac{246 + (945 + (3 \times 159))}{6}$

D. $246 + (945 + (3 \times 159))$

[1 mark]

Question 16

The distribution of molecular energies in a sample of a gas at a given temperature is shown by the Boltzmann distribution graph below.



If the temperature is increased, what will happen to the position of point X?

A fewer molecules possess the most probable energy value so X will shift to the right

B fewer molecules possess the most probable energy value so X will shift to the left

C more molecules possess the most probable energy value so X will shift to the left

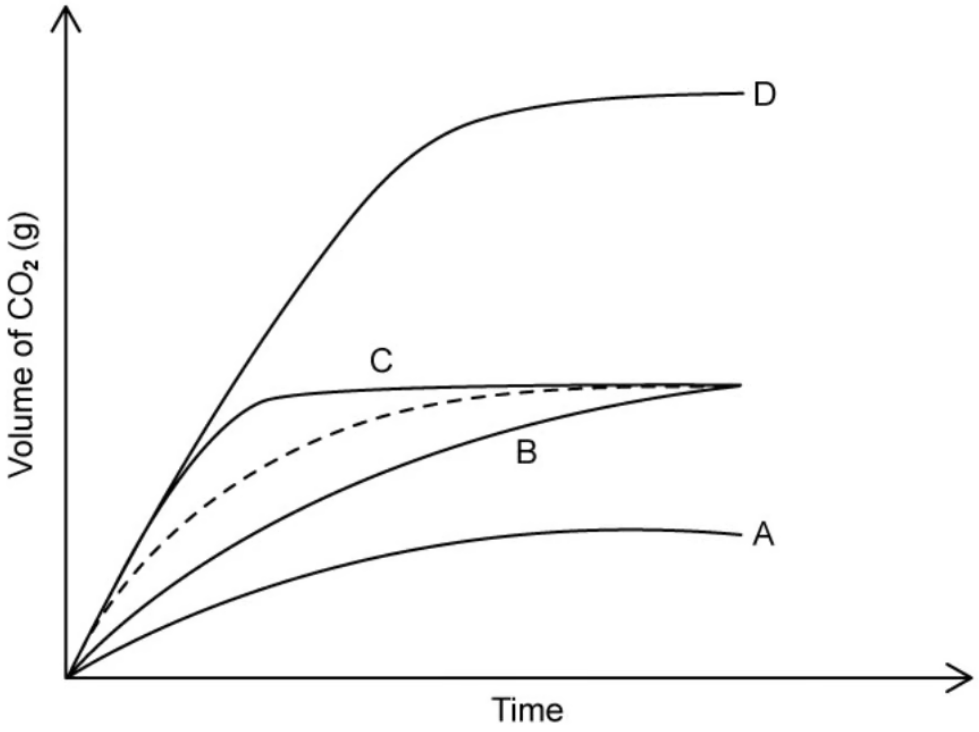
D the position of X will stay the same but the area under the distribution curve increases

[1 mark]

Question 17

In a reaction between 1M hydrochloric acid and an excess of marble chips (calcium carbonate) the volume of gas produced was measured against time. This is shown on the dotted line in the graph below.

The experiment was repeated, but this time using the same volume of 2M hydrochloric acid. Which line on the graph represents this experiment?



[1 mark]

Question 18

Study the following equilibrium reaction and determine which of the statements must be true.

$$2X \rightleftharpoons Y \qquad K_c = 1.1$$

A $[X] \gg [Y]$

B $[X] > [Y]$

C $[X] = [Y]$

D $[X] < [Y]$

[1 mark]

Question 19

Some species may be classified as amphiprotic, some as amphoteric and some as both. Which of the following applies to HPO_4^{2-}?

A. Amphiprotic but not amphoteric

B. Amphoteric but not amphiprotic

C. Amphiprotic and amphoteric

D. Neither amphiprotic nor amphoteric

[1 mark]

Question 20

Determine which of the following solutions would be basic at 25 °C?

$K_w = 1.0 \times 10^{-14}\ mol^2\ dm^{-6}$

A. $[H^+] = 1.0 \times 10^{-2}\ mol\ dm^{-3}$

B. $[OH^-] = 1.0 \times 10^{-12}\ mol\ dm^{-3}$

C. solution of pH = 5.00

D. $[H_3O^+] = 1.0 \times 10^{-12}\ mol\ dm^{-3}$

[1 mark]

Question 21

Oxidation numbers can be used to balance equations. Chlorine and hot aqueous sodium hydroxide react to produce chloride ions, chlorate ions and water.

What are the values of the coefficients **p**, **r** and **s** in the equation?

$$\mathbf{p}Cl_2(g) + \mathbf{q}OH^-(aq) \rightarrow \mathbf{r}Cl^-(aq) + \mathbf{s}ClO_3^-(aq) + \mathbf{t}H_2O(l)$$

	p	r	s
A	3	5	1
B	3	6	2
C	2	5	1
D	2	4	2

[1 mark]

Question 22

When heated ammonium nitrate, NH_4NO_3, can decompose explosively.

$$NH_4NO_3 \rightarrow N_2O + 2H_2O$$

The nitrogen atoms in NH_4NO_3 have different oxidation numbers.

What are the oxidation numbers for each of the N atoms when this reaction proceeds?

A +4, –4 **B** –2, –4 **C** +4, –6 **D** +2, +6

[1 mark]

Question 23

Below are three statements about voltaic cells.

I. A redox reaction takes place which produces electrical energy

II. At the cathode an oxidation reaction occurs

III. Electrons move from the anode to the cathode

The correct statements are

A I and II only

B I and III only

C II and III only

D I, II and III

[1 mark]

Question 24

How many isomers, including structural and stereoisomers, with the formula C_5H_{10} have structures that involve π bonding?

A 3 **B** 4 **C** 5 **D** 6

[1 mark]

Question 25

Study the formulae shown below and determine which molecules are isomers of each other

I. $CH_3(CH_2)_3CH_2CH_3$

II. $(CH_3)_2CHCH_2CH_3$

III. $CH_3CH(CH_3)CH_2CH_2CH_3$

A I and II only

B I and III only

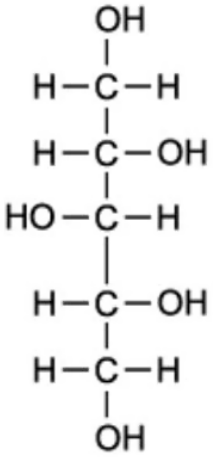
C II and III only

D I, II and III

[1 mark]

Question 26

Xylitol is an artificial sweetener used in toothpastes and chewing gum to improve their taste without impairing dental hygiene.



Xylitol

Which functional groups could be produced if Xylitol is oxidised under suitable conditions?

1 alkene

2 aldehyde

3 carboxylic acid

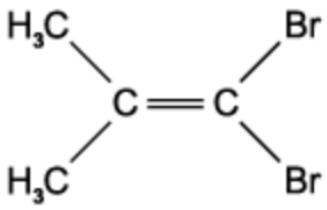
4 ketone

A 1 only **B** 2 only **C** 2, 3 and 4 **D** 2 and 4

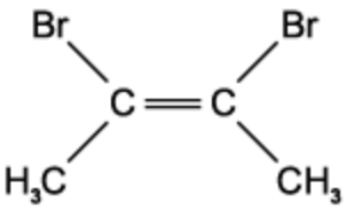
[1 mark]

Question 27

Isomers **X** and **Y** both react with HBr.



X



Y

A mixture of **X** and **Y** is reacted with HBr.

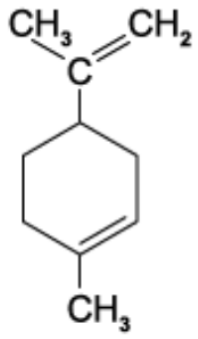
Which three structures represent three **different** possible products of this reaction?

A	$(CH_3)_2CHCBr_3$	$(CH_3)_2CBrCHBr_2$	$CH_3CHBrCHBrCH_3$
B	$(CH_3)_2CHCBr_3$	$(CH_3)_2CBrCHBr_2$	$CH_3CBr_2CHBrCH_3$
C	$(CH_3)_2CBrCBr_3$	$(CH_3)_2CHCBr_3$	$CH_3CBr_2CHBrCH_3$
D	$(CH_3)_2CBrCHBr_2$	$CHBr_2CBr(CH_3)CH_3$	$CH_3CHBrCBr_2CH_3$

[1 mark]

Question 28

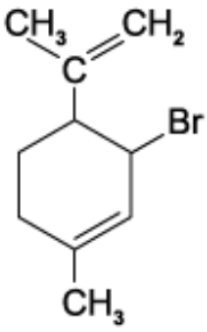
Limonene is an oil formed in the peel of citrus fruits.



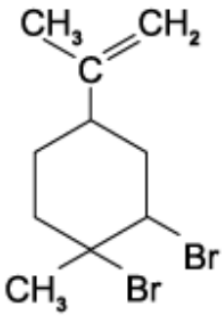
Limonene

Which product is formed when an excess of bromine, $Br_2(l)$, reacts with limonene at room temperature in the dark?

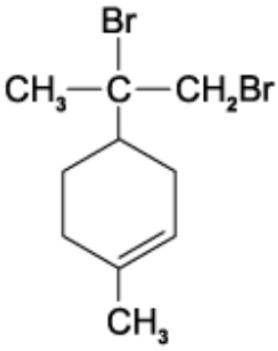
A



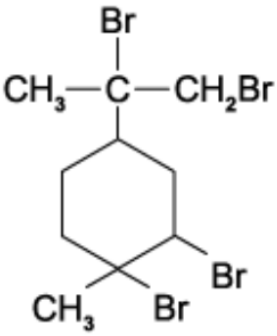
B



C



D



[1 mark]

Question 29

Which alcohol is **not** likely to have a fragment at *m/e* at 43 in its mass spectrum?

A $(CH_3)_2CHCH_2OH$

B $CH_3CH(OH)CH_2CH_2CH_3$

C $CH_3CH_2CH_2CH_2OH$

D $CH_3CH_2CH(OH)CH_3$

[1 mark]

Question 30

Which of the following statements about propanal, CH_3CH_2CHO, and propanone, CH_3COCH_3 is **not** correct?

The compounds have:

A molecular ion peaks at different mass to charge ratios

B different fragmentation patterns in the mass spectrum

C absorption in the infrared spectrum due to the carbonyl group

D a different fingerprint region in the infrared spectrum

[1 mark]