

# Practice Paper 1

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Total Marks

/30

1 A periodic table is needed for this question

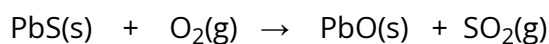
A compound has an empirical formula of  $C_2H_6O$  and a molar mass of 92.16.

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)

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



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

- A. 4
- B. 5
- C. 8
- D. 9

(1 mark)

- 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<sub>2</sub>
- C. SO<sub>3</sub>
- D. S<sub>2</sub>O<sub>3</sub>

(1 mark)

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

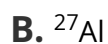
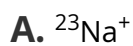
Assuming that the gas acts as an ideal gas, what is the temperature of the gas in K?

- 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)

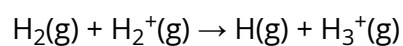
5 A periodic table is needed for this question

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



(1 mark)

6 The reaction shown occurs in gas clouds throughout the Universe.



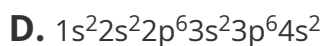
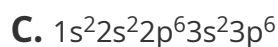
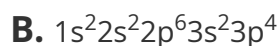
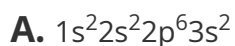
Which is the correct atomic structure of the  $\text{H}_3^+$  ion?

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

(1 mark)

7 Electron configurations for atoms of different elements are shown below.

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



(1 mark)

8 Which of the following statements about 2-methylpropan-2-ol,  $\text{CH}_3\text{C}(\text{CH}_3)(\text{OH})\text{CH}_3$ , are correct ?

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

A. I and II only

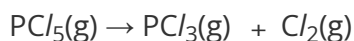
B. I and III only

C. II and III only

D. I, II and III

(1 mark)

9 The following equation shows the dissociation equilibrium of  $\text{PCl}_5$ .



The percentage yield of  $\text{PCl}_3$  varies with temperature.

At  $160^\circ\text{C}$   $\text{PCl}_3$  yield is 13% and at  $300^\circ\text{C}$  yield is 100%.

Which of the following rows is correct?

	The reaction is	Shape of $PCl_3$ molecule
<b>A</b>	exothermic	trigonal pyramidal
<b>B</b>	exothermic	trigonal planar
<b>C</b>	endothermic	trigonal pyramidal
<b>D</b>	endothermic	trigonal planar

(1 mark)

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

- A.** Na
- B.** Mg
- C.** Al
- D.** K

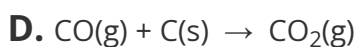
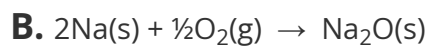
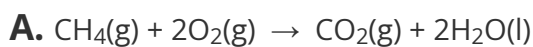
(1 mark)

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

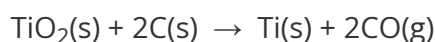
(1 mark)

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



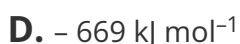
(1 mark)

13 Titanium occurs naturally as the mineral rutile,  $\text{TiO}_2$ . One possible method of extraction of titanium is to reduce the rutile by heating with carbon.



The standard enthalpy changes of formation of  $\text{TiO}_2(\text{s})$  and  $\text{CO}(\text{g})$  are  $-890 \text{ kJ mol}^{-1}$  and  $-110.5 \text{ kJ mol}^{-1}$  respectively.

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



(1 mark)

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



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

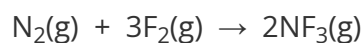
bond	bond energy / kJ mol <sup>-1</sup>
P-Cl (in both chlorides)	$x$
Cl-Cl	$y$

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)

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



The bond energy of  $\text{N}\equiv\text{N}$  is 945 kJ mol<sup>-1</sup> and F-F is 159 kJ mol<sup>-1</sup>

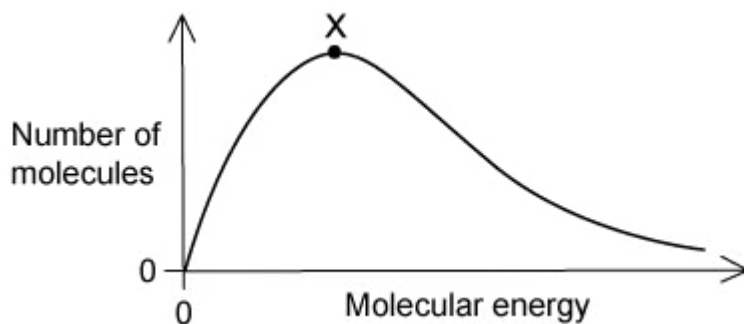
What is the bond energy of the N-F bond?

- 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)



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

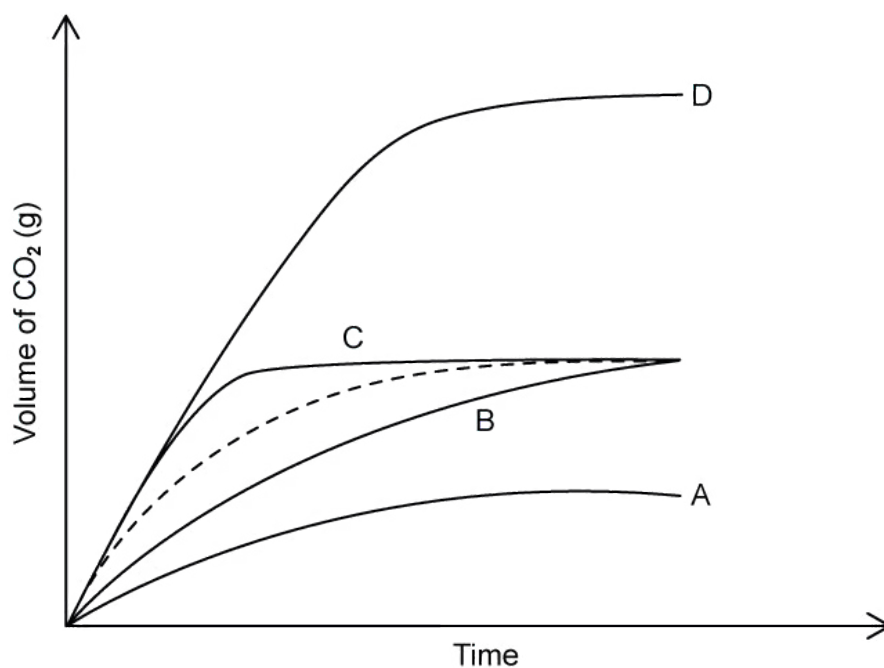


If the temperature is increased, what will happen to the position of point X?

- 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
- 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)



(1 mark)

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



- A.  $[X] \gg [Y]$
- B.  $[X] > [Y]$
- C.  $[X] = [Y]$
- D.  $[X] < [Y]$

(1 mark)

19 Some species may be classified as amphiprotic, some as amphoteric and some as both. Which of the following applies to  $\text{HPO}_4^{2-}$ ?

- A. Amphiprotic but not amphoteric
- B. Amphoteric but not amphiprotic
- C. Amphiprotic and amphoteric
- D. Neither amphiprotic nor amphoteric

(1 mark)

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

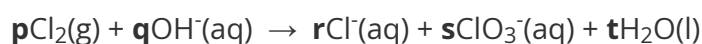
$$K_w = 1.0 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$$

- A.  $[\text{H}^+] = 1.0 \times 10^{-2} \text{ mol dm}^{-3}$
- B.  $[\text{OH}^-] = 1.0 \times 10^{-12} \text{ mol dm}^{-3}$
- C. solution of pH = 5.00
- D.  $[\text{H}_3\text{O}^+] = 1.0 \times 10^{-12} \text{ mol dm}^{-3}$

(1 mark)

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

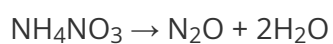
What are the values of the coefficients **p**, **r** and **s** in the equation?



	<b>p</b>	<b>r</b>	<b>s</b>
<b>A</b>	3	5	1
<b>B</b>	3	6	2
<b>C</b>	2	5	1
<b>D</b>	2	4	2

**(1 mark)**

**22** When heated ammonium nitrate,  $\text{NH}_4\text{NO}_3$ , can decompose explosively.



The nitrogen atoms in  $\text{NH}_4\text{NO}_3$  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)**

**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)**

**24** How many isomers, including structural and stereoisomers, with the formula  $C_5H_{10}$  have structures that involve  $\pi$  bonding?

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

**(1 mark)**

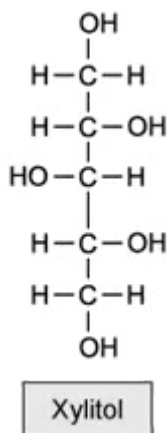
25 Study the formulae shown below and determine which molecules are isomers of each other

- I.  $\text{CH}_3(\text{CH}_2)_3\text{CH}_2\text{CH}_3$
- II.  $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_3$
- III.  $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{CH}_3$

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

(1 mark)

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



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

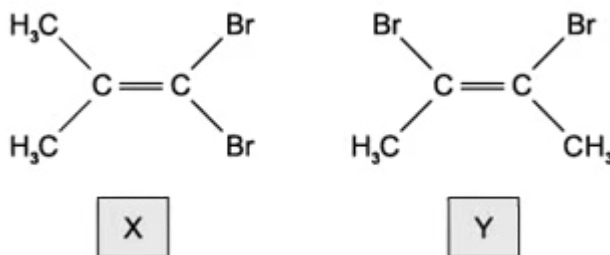
B. 2 only

C. 2, 3 and 4

D. 2 and 4

(1 mark)

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



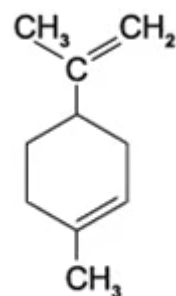
A mixture of **X** and **Y** is reacted with HBr.

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

- A  $(\text{CH}_3)_2\text{CHCBr}_3$      $(\text{CH}_3)_2\text{CBrCHBr}_2$      $\text{CH}_3\text{CHBrCHBrCH}_3$
- B  $(\text{CH}_3)_2\text{CHCBr}_3$      $(\text{CH}_3)_2\text{CBrCHBr}_2$      $\text{CH}_3\text{CBr}_2\text{CHBrCH}_3$
- C  $(\text{CH}_3)_2\text{CBrCBr}_3$      $(\text{CH}_3)_2\text{CHCBr}_3$      $\text{CH}_3\text{CBr}_2\text{CHBrCH}_3$
- D  $(\text{CH}_3)_2\text{CBrCHBr}_2$      $\text{CHBr}_2\text{CBr}(\text{CH}_3)\text{CH}_3$      $\text{CH}_3\text{CHBrCBr}_2\text{CH}_3$

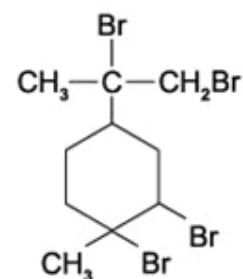
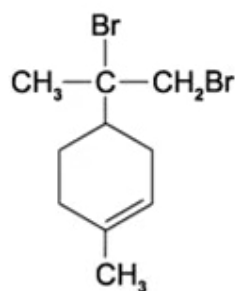
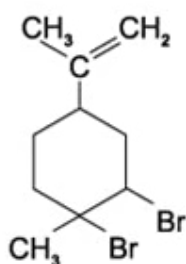
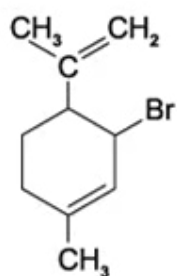
(1 mark)

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



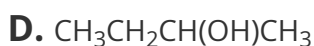
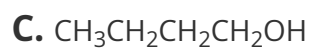
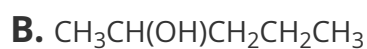
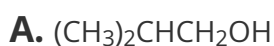
Limonene

Which product is formed when an excess of bromine,  $\text{Br}_2(\text{l})$ , reacts with limonene at room temperature in the dark?



(1 mark)

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



(1 mark)



**30** Which of the following statements about propanal,  $\text{CH}_3\text{CH}_2\text{CHO}$ , and propanone,  $\text{CH}_3\text{COCH}_3$  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)**