SEKOLAH MENENGAH KEBANGSAAN RAJA PEREMPUAN

PEPERIKSAAN AKHIR   TAHUN 2009

KIMIA   – KERTAS 2

T6R

TINGKATAN : 6 RENDAH

MASA : $2\frac{1}{2}$ JAM

NAMA : _____

KELAS : _____

Instructions to candidates :

DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO

Answer **all** questions in Section A.
Write your answers in the spaces provided.
All working should be shown.
For numerical answers, units should be quoted
wherever they are appropriate.

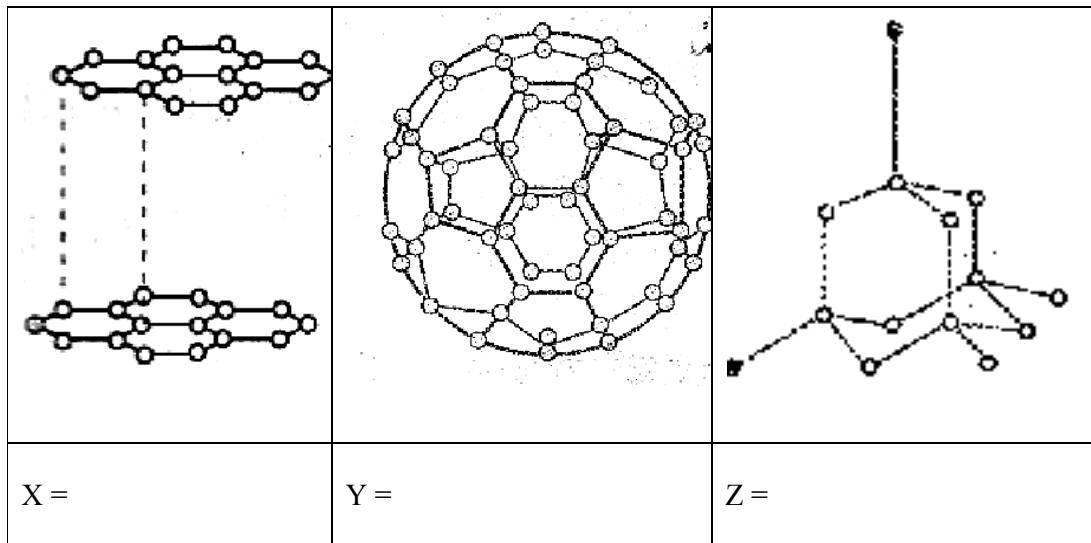Answer any **four** questions in Section B.
Begin each answer on a fresh sheet of paper
and arrange your answers in numerical order.

For examiner's use	
1	
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Total	

This question paper consists of 8 printed pages and 0 blank page .

1. The diagram below shows the arrangement of atoms in the three allotropes of carbon.

| X = | Y = | Z = |

a) Name the allotropes X, Y and Z. [3 marks]

b) Compare the densities of X and Z. Which allotrope is denser? Explain.

    _____

    _____ [2 marks]

c) Compare the electrical conductivities of X and Z. Which allotrope is able to
    conduct electricity? Explain.

    _____

    _____ [2 marks]

d) What is the hybridization of the carbon atoms in Y?

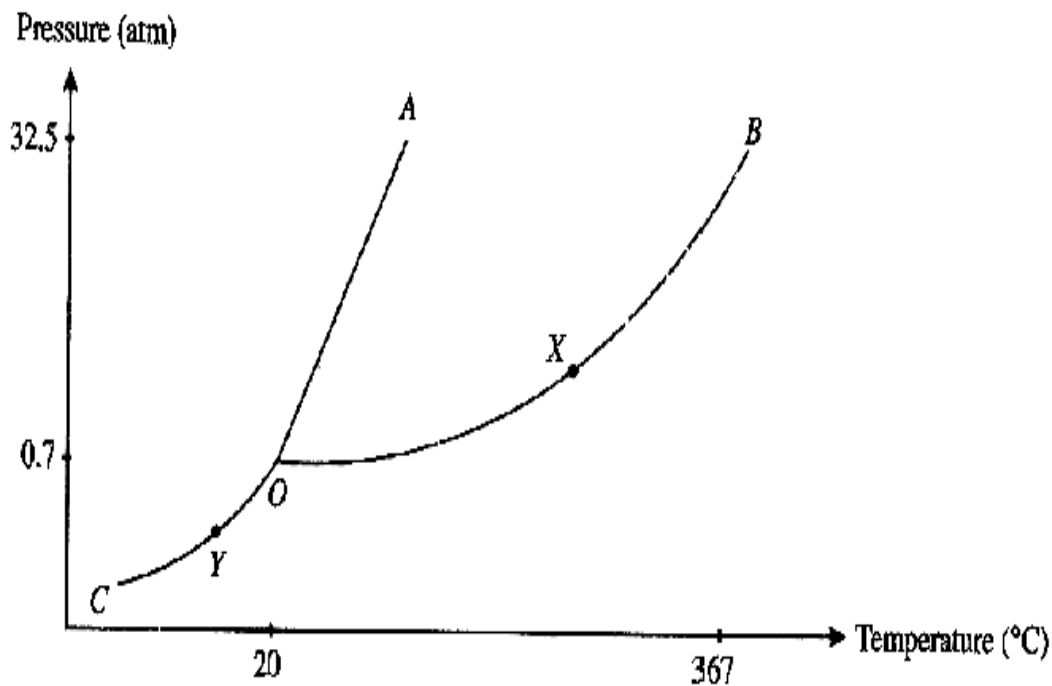   _____ [1 mark]

e) What is the product formed when Y is completely burned?

    _____ [1 mark]

f) Write an equation for the reaction in (e).

    _____ [1 mark]

2. The phase diagram for a substance R (which is not drawn to scale) is shown below.

Pressure (atm)

a) Label the three areas of the phase diagram.   [2 marks]

b) Indicate on the diagram the normal boiling point of R.   [1 mark]

c) Explain what is represented by the points O and B?

_____

_____ [2 marks]

d) How is the composition of substance R at point X different from the
   composition at point O ?

_____

_____ [2 marks]

e) Explain what would happen to substance R at point Y when the pressure is
   increased?

_____

_____ [2 marks]

f) What does the slope of the line AO suggest about the physical properties of the
   substance R?

_____ [1 mark]

2

3. (a)(i)   Explain what is meant by an "ideal gas"

_____ [1 mark]

   (ii)   Describe the characteristics of an "ideal gas"

   _____

   _____ [2 marks]

   (iii)   Give an example of a gas that behaves as an ideal gas.

   _____ [1 mark]

   (iv)   State two **conditions** where a real gas behaves as an ideal gas.

   _____

   _____ [2 marks]

(b) The density of a gas was determined at different pressures. The following results
    were obtained at $0^{o}C$.

Density, ρ (g dm^{-3})	0.312	0.625	0.937	1.249
Pressure, p (atm)	0.25	0.50	0.75	1.00

   (i) Plot a graph of density against pressure.   [2 marks]

   (ii) Calculate the relative molecular mass of the gas.   [2 marks]

4.   The six consecutive ionization energies (kJ mol^{-1}) of an element M are as follows:

	E_1	E_2	E_3	E_4	E_5	E_6	E_7
Ionisation energy (kJ mol^{-1})	419	3051	4411	5877	7975	9650	11343

(a)(i) Calculate the difference in the consecutive ionisation energies.

[1mark]

3

(ii) In which group of the periodic table can M be found? Explain you: answer.

_____

_____ [2 marks]

(iii) Comment on the ionisation energy difference between E_4 and E_5 and between E_5 and E_6.

_____ [1mark]

(b) If M is found in the fourth period,
(i) identify M.

_____ [1 mark]

(ii) write the valence electronic configuration of M.

_____ [1 mark]

(iii) sketch the shapes of orbitals that the valence electrons of M could be located.

[1 mark]

(c) The proton number of element X is smaller than the proton number of element M by 1.
(i) Do you think that the first ionisation energy of X will be smaller or larger than M?

_____ [1 mark]

(ii) Suggest a reason for your answer.

_____ [1 mark]

(iii) Write the possible valence electronic configuration of X.

_____ [1 mark]

Section B
[60 marks]
Answer any **four** questions in this section

5. (a)(i)   State Avogadro's law   [1 mark]

    (ii) Calculate the volume of one mole of nitrogen dioxide gas at standard
          temperature and pressure .   [2 marks]

    (iii) What is the volume of 1 mole of nitrogen gas? Explain your answer.   [2 marks]

    (b) In organic chemistry, sulphur dichloride oxide or thionyl chloride, $SOCl_2$, is
         used to convert carboxylic acids to acyl chlorides. When 1.02g sample of
         $SOCl_2$ is vaporized completely at standard temperature and pressure, the gas
         occupies a volume of 196 cm^3..
         (i) Calculate the relative molecular mass of $SOCl_2$ in the gaseous state.
         (ii) Calculate the relative molecular mass of $SOCl_2$ from its molecular
              formula. Compare this calculated value with the experimental value
              obtained in b(i).   [10 marks]

6. (a) Explain briefly how the emission spectrum for the hydrogen atom is formed.   [5 marks]

    (b) Each electron transition from a higher energy level to a lower energy level
         emits light with a fixed frequency. The frequency of each electron transition
         is shown in the table below.

Transition	$n_2 \rightarrow n_1$	$n_3 \rightarrow n_1$	$n_4 \rightarrow n_1$	$n_5 \rightarrow n_1$	$n_6 \rightarrow n_1$	$n_7 \rightarrow n_1$
n x 10^{14} Hz	24.53	29.07	30.66	31.39	31.79	32.03

    Calculate the frequency difference between each transition and plot a graph
    of frequency, **n** versus the frequency difference., **v** . Hence determine the
    ionization energy of hydrogen in kJ mol^{-1}.   [10 marks]

7. Explain the following observations as fully as you can.
    (a) The melting points of AlF_3 and PF_3 are 1291^0C and -151^0C respectively.   [3 marks]

    (b) Ethanoic acid and methyl methanoate are isomers and have the same relative
         molecular mass, 60.0. However the melting points of ethanoic acid and
         methyl methanoate are 17^0C and -99^0C respectively.   [3 marks]

    (c) The carbon dioxide molecule, CO_2 is linear but the sulphur dioxide molecule,
         SO_2 is V-shaped.

    (d) The melting points of 2- methyl-2 –propanol and 1-butanol are respectively
         26^0C and -90^0C but the boiling points are respectively 82^0C and 117^0C.   [3 marks]

(e) Copper is a good electrical conductor at room temperature but its conductivity decreases with increases in temperature. Silicon is a poor electrical conductor at room temperature but its conductivity increases with increase in temperature. [3 marks]

8. The following table contains ionization energy data

Element	N	O	F	Ne	Na
First ionisation energy / kJ mol $^{-1}$	1400	1310	1680	2080	494

(a) Explain the meaning of the term *first ionisation energy* of an element.   [2 marks]

(b) Explain why neon has a higher first ionisation energy than fluorine.   [3 marks]

(c) Explain why oxygen has a lower first ionisation energy than nitrogen.   [3 marks]

(d) Predict an approximate value for the first ionisation energy of carbon and explain your answer.   [3 marks]

(e) An element X has successive ionisation energies as follows :

   786,   1580,   3230,   4360,   16000,   20000,   23600,   29100 kJ mol^{-1}

   (i)   To which Group in the Periodic Table does X belong? Explain your answer.

   (ii) Write down the outer electronic configuration of an atom of X.   [4 marks]

9.

$$\boxed{CH_4} \quad \boxed{NH_3} \quad \boxed{H_2O}$$

(a)(i) Draw the shapes of each molecule, suggesting values for the bond angles.

   (ii)   State the type of intermolecular forces present for each hydride.

   (iii) Explain the variation in bond angles in these molecules.

   (iv) In which hydride is the intermolecular forces strongest ? Explain how you decided upon your answer.   [10 marks]

(b)(i) Draw 'dot-and-cross' diagrams to show the structures of the ammonia molecule and of the ammonium ion.

   (ii) Using the ammonium ion as an example, explain what is meant by the term *dative covalent bond.*

   (iii) The ammonium ion has a tetrahedral shape. Explain what this suggests about the four N—H bonds.   [5 marks]

10. (a)(i) Copy the diagram below and by using the symbols δ+ and δ- , indicate the polarity of the covalent bonds shown.
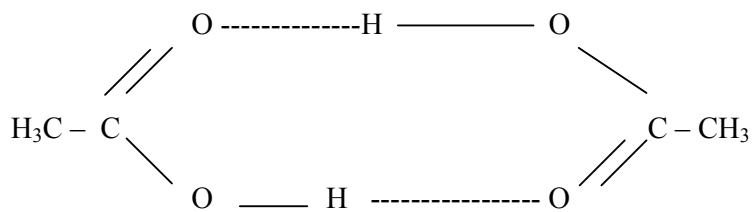
$$H_3C — Cl \qquad Cl — F \qquad CH_3\,CH_2\,N\begin{smallmatrix}\diagup H\\\diagdown H\end{smallmatrix}$$
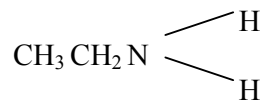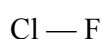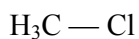
[4 marks]

(ii) Explain the term *electronegativity*. [2 marks]

(b) The diagram below shows the structure of ethanoic acid when dissolved in benzene.

$$
\begin{array}{c}
O \text{--------------} H \;———\; O \\
\diagup\!\diagup \qquad\qquad\qquad\qquad \diagdown \\
H_3C - C \qquad\qquad\qquad\qquad\qquad\qquad C - CH_3 \\
\diagdown \qquad\qquad\qquad\qquad\qquad \diagup\!\diagup \\
O \;——\; H \text{----------------} O
\end{array}
$$

(i) Calculate the relative molecular mass of ethanoic acid when dissolved in benzene. [2 marks]

(ii) Give the name of the type of bonding shown by the dashed line in the diagram above and explain how it arises. [4 marks]

(iii) When ethanoic acid is dissolved in water the relative molecular mass is slightly less than half the value calculated in b(i). Explain this observation by referring to the bonding shown in the diagram above. [3 marks]

END OF QUESTION PAPER