Draft

APPLECROSS

SENIOR HIGH SCHOOL

Chemistry ATAR 1+2

Properties, Structure and Bonding Test

Name : _Solutions_   Teacher: _____

TIME ALLOWED: 55 MINUTES   **(55 marks total)**

Part A: Multiple Choice Questions. (10 marks)

> For each question shade the box to indicate your answer.
> Use **only** a blue or black **pen** to shade the boxes.
>
> For example, if b is your answer: a ☐ b ■ c ☐ d ☐
>
> If you make a mistake, place a cross through that square and shade your new answer. **Do not** erase or use correction fluid/tape.
>
> For example, if b is a mistake and d is your answer: a ☐ b ☒ c ☐ d ■
>
> If you then want to use your first answer b, cross out d and then circle b.
>   a ☐ b⊗c ☐ d ☒
>
> Marks will **not** be deducted for incorrect answers.
> **No marks** will be given if more than one answer is completed for any question.

1	a ☐ b ☐ c ☐ d ■	9	a ☐ b ■ c ☐ d ☐
2	a ■ b ☐ c ☐ d ☐	10	a ☐ b ■ c ☐ d ☐
3	a ☐ b ■ c ☐ d ☐	11	a ☐ b ☐ c ■ d ☐
4	a ☐ b ■ c ☐ d ☐	12	a ☐ b ☐ c ■ d ☐
5	a ☐ b ☐ c ■ d ☐	13	a ☐ b ■ c ☐ d ☐
6	a ☐ b ■ c ☐ d ☐	14	a ■ b ☐ c ☐ d ☐
7	a ☐ b ■ c ☐ d ☐	15	a ☐ b ☐ c ■ d ☐
8	a ☐ b ☐ c ☐ d ■		

Section B: Short Answer Questions (45 marks)

1. To answer question 1 refer to the information given in the table below:

Substance	Melting point (^0C)	Boiling point (^0C)	Solubility in water at 20^0C (grams per 100 g of water)	Solubility in water at 80^0C (grams per 100 g of water)
potassium bromide	734	1435	60	90
Calcium	842	1484	N A	N A
methanol, CH_3OH	−98	65	very soluble	very soluble

a) List the compound or compounds that are likely to be covalent molecular?   (1 mark)

methanol

b) Explain in terms of the bonding why the melting point of potassium bromide is so high. 2

(3 marks)

Strong ionic bond

Ionic lattice of alternating K⁺ and Br⁻ ions has very strong electrostatic forces.

c) Explain in terms of the bonding why the melting point of methanol is so low.   2

(3 marks)

Methanol is covalent molecular
Atoms making up molecule are held strongly together but molecules are held by weak intermolecular forces.

3. Atoms *W, X, Y* and *Z* have the following electron configurations:

$$W: 2, 8, 2 \quad X: 2, 5 \quad Y: 2, 8 \quad Z: 2, 8, 7$$

(a) Which element, *W, X, Y* or *Z*, would be least reactive and which group of the periodic table is it a member? (2 marks)

Y   nobel gases (group 18)

(b) Which element is in group 15 of the periodic table and state the formula for its elemental form? (2 marks)

X N_2 or X_2

(c) Which element would form a positive ion that has the same electron configuration as neon? (1 mark)

W

(d) Give the formula of the substance formed when *W* and *X* react. (1 mark)

$W_3 X_2$

(e) What type of bond would form when *X* reacts with *Z* to form a compound? (1 mark)

Covalent

(f) Explain why element "W" forms an ion **and** why that ion has a charge of "+2". (2 marks)

W has only 2 valence electrons.
Loses both to obtain a full outer shell

4. Explain the following observations in a **sentence or two** using your knowledge of the structure of materials.

  (a) Ionic solids will not conduct electricity in the solid state. (1 mark)

  No mobile charges
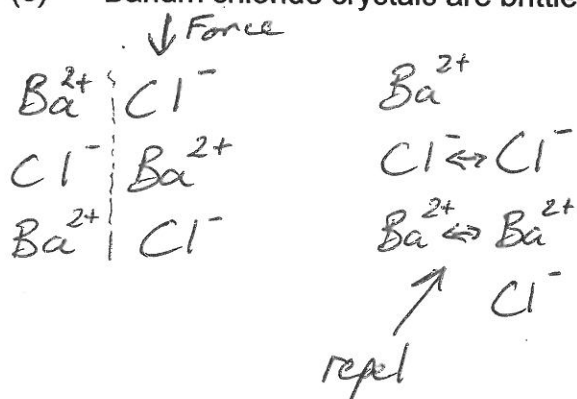 (e^- not free to move, ions not free to move)

  (b) Metals have lustre. (1 mark)

  Delocalised Electrons reflect light or
  Close packing of metal cations prevents light from passing through

  (c) Barium chloride crystals are brittle. (2 marks)

  $\downarrow$ Force
  $Ba^{2+} | Cl^-$
  $Cl^- | Ba^{2+}$
  $Ba^{2+} | Cl^-$

  Ba^{2+}
  $Cl^- \leftrightarrow Cl^-$
  $Ba^{2+} \leftrightarrow Ba^{2+}$
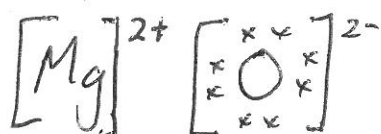 $\nearrow Cl^-$
  repel

  Force pushes like charges together so they repel and shatter the force of attraction.

5. Draw electron dot diagrams of the following substances:

  (a) MgO (2 marks)

  $[Mg]^{2+} [\overset{x\,x}{\underset{x\,x}{\overset{x}{O}\,^x}}]^{2-}$

  (b) PCl_2F (2 marks)

  $\overset{x\,x}{\underset{x\,x}{\overset{x}{Cl}\,^x}} \overset{\bullet\bullet}{\underset{x\,\bullet}{P}} \overset{x\,x}{\underset{x\,x}{\overset{x}{Cl}\,^x}}$

  $\overset{x}{\underset{x\,x}{\overset{x}{F}\,^x}}$
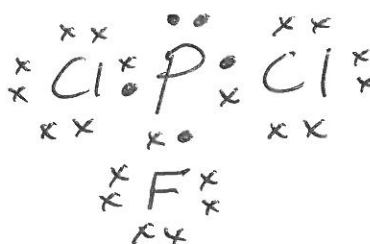
6. (a) What is a nanoparticle? (1 mark)

particles of size 1 - 100 nm

$10^{-9} \rightarrow 10^{-7}$ m

Have different properties to same matterial with normal sized particles

(b) Give an example of nanoparticle and its use. (2 marks)

Carbon nanotubes - electronics + optics
gold - electron microscopy, electronics, materials science, fight cance
ZnO, TiO_2 - sunscreens
$CdSe$ - biological tracers
silver - antibacterial

7. (a) Name the type of bonding to which diamond and graphite belong. (1 mark)

Covalent Network

(b) Describe the major difference in the bonding of these two allotropes of carbon? (2 marks)

Diamond has 3 dimensional covalent bonding with all 4 valence electrons being used

In graphite only 3 of the valence electrons are used leaving the 4th to be delocalised. Forms parallel, flat layers (2 dimensions) with only weak forces holding the layers together.

(c) Why is graphite able to act as a solid lubricant? (2 marks)

Weak forces between the layers of graphite allows the layers to slide over each other. Makes it feel slippery.

8. Classify the following as homogeneous or heterogeneous:

(b) Sand in water. ___heterogeneous___

(c) Liquid mercury and molten salt. ___heterogeneous___

(d) $CuSO_4$ dissolved in water. ___homogeneous___

(3 marks)

9. We use many materials in our daily life for a wide range of applications.
Give an **example** of each of the following **and** a corresponding use **in the real world**:

(a) A covalent network material, (2 marks)

graphite in pencils
SiO_2 in glass

(b) A metallic substance. (2 marks)

copper - conducting electricity
Iron/steel - Structural uses

10.

Substance	Melting Point (^0C)	Boiling Point (^0C)	Electrical Conductivity	
			In solid state	In liquid state
A	175	1345	non-conductor	non-conductor
B	867	1579	non-conductor	conductor
C	-120	76	non-conductor	non-conductor
D	1386	2987	conductor	conductor

Classify each substance as a metal, ionic, covalent network or covalent molecular substance.

A ___Covalent network___

B ___Ionic___

C ___Covalent molecular___

D ___Metal___

(4 marks)

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11. Calculate the percentage composition by mass of;

(a) Silicon in SiO_2 $FM(SiO_2) = 28.09 + 2 \times 16$ (2 marks)
$$= 60.09$$

$$\% \, Si = \frac{28.09}{60.09} \times 100$$

$$\% \, Si = 46.7\%$$

(b) Oxygen in $CaSO_4$ (2 marks)

$$FM(CaSO_4) = 40.08 + 32.07 + (4 \times 16)$$
$$= 136.15$$

$$\% \, O = \frac{(4 \times 16)}{136.15} \times 100$$

$$\% \, O = 47.03\%$$

End of Test