Suggested Answers on Note (Chapter 7) P.6

1. (a) 4
   (b) 8
   (c) CaF_2

2. (a) 8
   (b) 8
   (c) CsCl

Suggested Answers on Note (Chapter 7) P.9

	Solid state	Molten / Aqueous state
Electrical Conductivity	**Conduct**	**Not conduct**
Reason	**Ions are fixed**	**Ions are mobile**

Exercise

1. No. Because ionic compounds do not conduct electricity in solid state.
2. No. Because the ions of potassium bromide in solid state are fixed. They are not movable. Therefore, potassium bromide in solid state cannot conduct electricity.

Suggested Answers on Note (Chapter 7) P.12

Simple molecular substances mix with	Solubility
Water / polar solvent	**Insoluble**
Non-aqueous / non-polar / organic / dry solvent	**Soluble**

Suggested Answers on Note (Chapter 7) P.13

1. E < C < A < B < D
2. Krypton > argon > neon > helium
   Masses and sizes of their molecules decrease in the stated order. Their van der Waals' forces of the four gases decreases accordingly.
3. No. Oxygen has a low boiling point because oxygen **molecules** are held together by **weak van der Waals' forces**.

Suggested Answers on Note (Chapter 7) P.16

B. Strength and hardness

	Diamond	Quartz	Graphite
Hardness	**Very hard**	**Very hard**	**Hard but brittle**
Reason	**Atoms are held together by strong covalent bond**	**Atoms are held together by strong covalent bond**	**Atoms are held together by strong covalent bond But Layers are held together by weak van der Waal's forces**

C. Melting point and boiling point

	Diamond	Quartz	Graphite
Melting point (°C)	3550	1610	3730
Reason	**Atoms are held together by strong covalent bond.**		

Suggested Answers on Note (Chapter 7) P.17

E. Electrical conductivity

	Diamond	Quartz	Graphite
Electrical Conductivity	**Not conduct**	**Not conduct**	**Conduct**
Reason	**No mobile electrons or ions / no charged particles**		**Delocalized electrons present**

Exercise

1. Dry ice has simple molecular structure while quartz has giant covalent structure.
2. Diamond is very hard because all the carbon atoms are held together by strong covalent bond. Graphite is another form of carbon. It has a layered structure. Layers are held together by weak van der Waals' forces. Hence, graphite is hard by brittle.

Suggested Answers on Note (Chapter 7) P.19

Exercise:

(a) Strength of metallic bond: Lithium > sodium > potassium > caesium
Reason: the number of electron shells in their atoms increase
⇒ the size of cation increase
⇒ attraction between cation and delocalised electron decrease
⇒ strength of metallic bond decrease

(b) Strength of metallic bond: aluminium > magnesium > sodium
Reason: the number of delocalised electrons decrease and the charge of the cation increase
⇒ attraction between cation and delocalised electron decrease
⇒ strength of metallic bond decrease

Conclusion:

(a) The strength of metallic bond (**increase** / decrease) across a period.
(b) The strength of metallic bond (increase / **decrease**) down a group.

Suggested Answers on Note (Chapter 7) P.23 – 29

1. Copper is a good conductor of heat because copper has a giant metallic structure. Mobile electrons / delocalised electrons are present to help the conduction of heat.
Copper atoms are packed in layers. Layers can slip over one another without breaking the strong metallic bond. Hence, copper is malleable and ductile.

2.

Substance	Structure	Atoms contained	Type of attractive force
Quartz	**Giant covalent**	**Silicon, oxygen**	**Covalent bond**
Potassium bromide	**Giant ionic**	**Potassium, bromine**	**Ionic bond**
Hydrogen sulphide	**Simple molecular**	**Hydrogen, sulphur**	**Covalent bond with molecule, van der Waasls' forces between molecules**
Beryllium	**Giant metallic**	**Beryllium**	**Metallic bond**

3. (a) A and F
   (b) B
   (c) C, E and I
   (d) A, B and F
   (e) D, G and H
   (f) B

4. (a) Strontium is a metal while chlorine is a non-metal.
   Ionic bonds would form between them.

   (b) Strontium chloride has a giant ionic structure.

   (c) Strontium is a Group II element. It forms an ion carrying 2 positive charges, i.e. Sr^{2+}.
   Chlorine is a Group VII element. It forms an ion carrying 1 negative charge, i.e. Cl^-.
   The net charge of the compound must be zero.
   Therefore, the simplest ratio of Sr^{2+} to Cl^-.
   In the compound should be 1 : 2.
   The chemical formula of strontium chloride is $SrCl_2$.

   (d) (i) The compound is hard because the ions in it are held together by strong ionic bonds.

   (ii) The compound has high melting point. To melt the compound, a lot of heat energy is needed to overcome the strong attractive forces (ionic bonds) between the ions.

   (iii) The compound conducts electricity in molten state or aqueous solution because mobile ions are present.

5. (a) Element X is carbon (non-metal) while element Y is sulphur (non-metal).
   Covalent bonds would form between them.

   (b) Z has a simple molecular structure.

   (c) To obtain a stable electronic arrangement, a compound atom needs 4 electrons while a sulphur atom needs 2 electrons. The chemical formula of Z is CS_2.

   (d) (i) Z has a low boiling point because the van der Waals' forces between the molecules are weak.

   (ii) Z is insoluble in water. It is because the weak attractive forces between molecules of Z and water molecules are not strong enough to overcome the attractive forces between the water molecules.

   (iii) Z does not conduct electricity because it does not contain mobile electrons or ions.

6. (a) Ionic bond

   (b) Giant ionic structure

   (c) (i) Z has high melting point and boiling point.
   To melt or boil it, a lot of heat energy is needed to overcome the strong ionic bonds between the ions.

   (ii) Z conducts electricity in molten state or aqueous solution because mobile ions are present.

7. (a) D has a simple molecular structure because its melting and boiling points are low.

   (b) B has a giant metallic structure because its melting and boiling points are high. Also, it can conduct electricity in both solid and molten states.

   (c) A has a giant ionic structure because its melting and boiling points are high. Also, it can conduct electricity in molten state but not in solid state.

   (d) C has a giant covalent structure because its melting and boiling points are very high. Also, it does not conduct electricity.

8. (a) (i) Substance Y
   Y has a high melting point and is a good conductor of electricity in solid state.

   (ii) Substance X
   X has a high melting point and is very soluble in water.

   (b) Z is a covalent compound. The elements forming Z are non-metals.

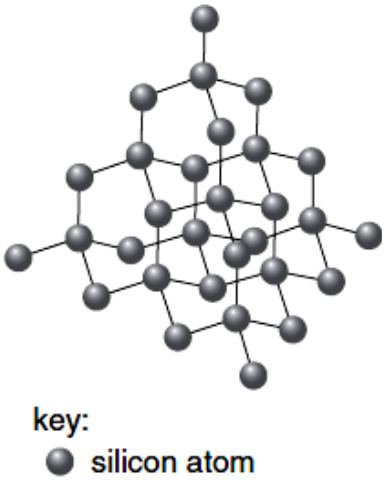
   (c) The attractive forces between water molecules are quite strong. The weak attractive forces between the molecules of Z and water molecules are not strong enough to overcome the attractive forces between the water molecules.

Suggested Answers on Note (Chapter 7) P.35 – 41

1. (a) Carbon dioxide has a simple molecular structure.
Weak van der Waals' forces hold the molecules together. Little heat is needed to separate the molecules. Hence carbon dioxide has a low boiling point and it is a gas at room conditions.

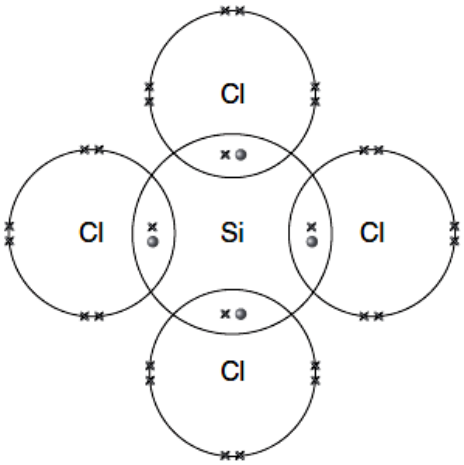
Silicon dioxide has a giant covalent structure.
A lot of heat is needed to overcome these bonds during melting. Hence silicon dioxide has a high melting point and it is a solid at room conditions.

(bI (i)



(ii) Silicon has a high melting point.
In silicon, each atom is covalently bonded to four other atoms in a giant structure.
A lot of heat is needed to overcome these bonds during melting.

(c)



2. (a) (i) Sodium chloride is made up of sodium ions and chloride ions arranged in a cubic pattern.
In the lattice, each sodium ion is surrounded by 6 chloride ions and each chloride ion is surrounded by 6 sodium ions.

(ii) In graphite, the carbon atoms are arranged in flat parallel layers.
Within each layer, each carbon atom is covalently bonded to three other atoms, forming a hexagonal arrangement.
There are weak van der Waals' forces between the adjacent layers.

(b) Graphite has a layered structure. The layers are held by weak van der Waals' forces.
When graphite is pressed onto a piece of paper, the layers slide over each other and flake off easily onto the paper.

(c) (i) Molten sodium chloride conducts electricity due to the presence of mobile ions in molten sodium chloride.

(ii) In solid graphite, each carbon atom has four outermost shell electrons. Each carbon atom uses three electrons in forming covalent bonds.
The remaining electron is delocalized between the layers of carbon atoms. Graphite conducts electricity due to the presence of delocalized electrons.

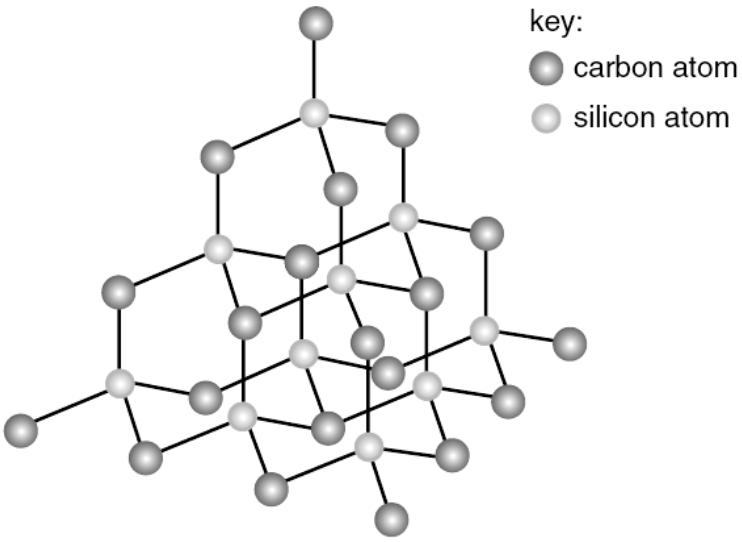
3. (a) A — sodium chloride
B — diamond
C — iodine

(b) (i) Ionic bonding
(ii) Covalent bonding

(c) Solid A has a higher melting point.
A lot of heat is needed to overcome the strong ionic bonds between the ions in A.
On the other hand, weak van der Waals' forces exist between the molecules in solid C.
Little heat is needed to separate the molecules.

(d) A can conduct electricity in molten state or aqueous solution as ions in A become mobile in molten state or aqueous solution.

4. (a)



(b) In silica, covalent bonds hold all the outermost shell electrons of the atoms firmly together. There are no mobile electrons or ions. Hence it does not conduct electricity.

5. (a) The outermost shell electrons of each metallic atom are free to move randomly in a piece of metal.
Hence a piece of metal consists of positively charged ions surrounded by a 'sea' of electrons.

(b) Copper is a good conductor of electricity due to the movement of mobile electrons.
When a piece of copper is connected to a battery, mobile electrons in the metal flow towards the positive terminal of the battery.
At the same time, electrons flow into the other end of the metal from the negative terminal of the battery.

(c) Ions in copper are packed in layers.
When we apply a force to a piece of copper, the layers slide through the 'sea' of electrons to new positions.
The metal does not break because the ions are still bound together by the 'sea' of electrons. As a result, copper can be drawn into wires.

6. (a) E
It can only conduct electricity in molten state but not in solid state.

(b) B, C
B has a very low melting point and it does not conduct electricity.
C does not conduct electricity and it has a low melting point.

(c) D
It can conduct electricity in both solid and molten states.

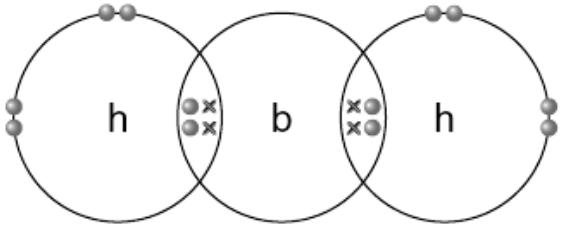
(d) A
It has a very high melting point and it does not conduct electricity.

7. (a) (i) f
(ii) g

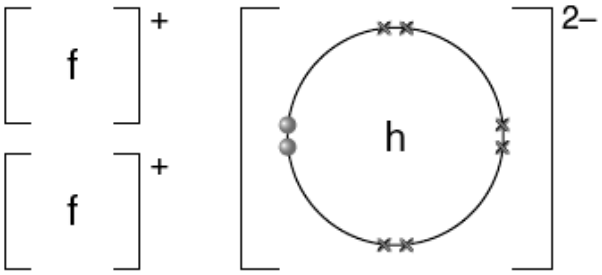
(b) Noble gases

(c) b

(d) (i) Compound formed between elements b (carbon) and h (sulphur).



Compound formed between elements f (sodium) and h (sulphur).



(ii) The forces between particles in the compound formed between b and h are weak van der Waals' forces.
The forces between particles in the compound formed between f and h are strong ionic bonds.
Particles in the first compound separate easily. Hence the compound formed between b and h is more volatile