

1 Which of the following has the highest melting temperature?

- A Hg
- B K
- C C<sub>10</sub>H<sub>22</sub>
- D SiO<sub>2</sub>

(Total for Question = 1 mark)

2 Which of these has a dative covalent bond?

- A NH<sub>3</sub>
- B OH<sup>-</sup>
- C H<sub>2</sub>O
- D H<sub>3</sub>O<sup>+</sup>

(Total for Question = 1 mark)

3 Which of the following compounds has the most polarized **anion**?

- A Na<sub>2</sub>O
- B MgO
- C K<sub>2</sub>O
- D CaO

(Total for Question = 1 mark)

4 Which of the following molecules is polar?

- A Carbon dioxide,  $\text{CO}_2$
- B Silicon tetrachloride,  $\text{SiCl}_4$
- C Ammonia,  $\text{NH}_3$
- D Boron trifluoride,  $\text{BF}_3$

(Total for Question = 1 mark)

5 In which series of compounds does covalent character **increase** when going from left to right?

- A KI, KBr, KCl
- B NaI, KI, RbI
- C NaCl,  $\text{MgCl}_2$ ,  $\text{AlCl}_3$
- D  $\text{SO}_2$ ,  $\text{P}_4\text{O}_{10}$ ,  $\text{SiO}_2$

(Total for Question = 1 mark)

6 Which of the following contains a dative covalent bond?

- A  $\text{N}_2$
- B  $\text{NH}_3$
- C  $\text{NH}_2^-$
- D  $\text{NH}_4^+$

(Total for Question = 1 mark)

7 Which of the following molecules does **not** contain a double bond?

- A  $\text{CO}_2$
- B  $\text{C}_2\text{Cl}_4$
- C  $\text{C}_3\text{F}_8$
- D  $\text{C}_2\text{H}_2\text{Cl}_2$

**(Total for Question = 1 mark)**

8 The bonding in lithium iodide has some covalent character because

- A the lithium ion polarizes the iodide ion.
- B the iodide ion polarizes the lithium ion.
- C there is a very large difference in electronegativity between lithium and iodine.
- D there is a very small difference in electronegativity between lithium and iodine.

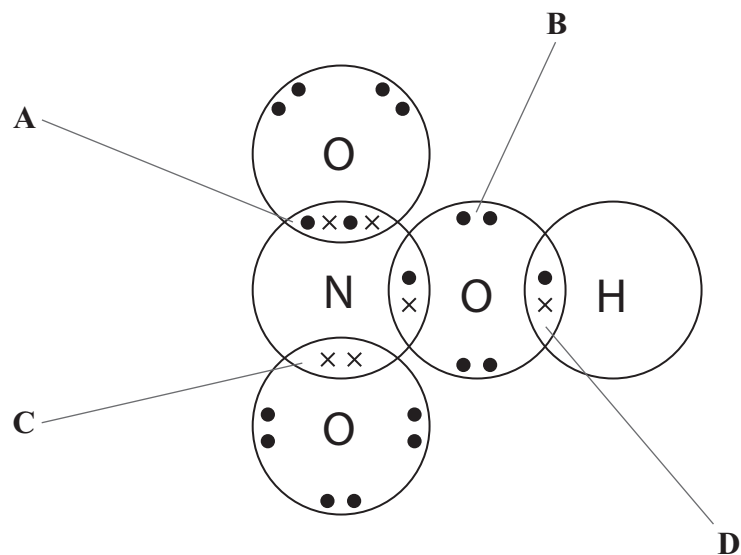
**(Total for Question = 1 mark)**

9 Which of the following is a pure form of carbon that has both hexagonal and pentagonal rings in its structure and can conduct electricity?

- A Charcoal
- B Buckminsterfullerene
- C Diamond
- D Graphite

**(Total for Question = 1 mark)**

10 The diagram below shows a dot and cross diagram of nitric acid.



(a) Identify which of the labelled sets of electrons represents a dative covalent bond.

(1)

- A
- B
- C
- D

(b) In terms of orbital overlap, the double bond is

(1)

- A a  $\pi$  bond.
- B two  $\sigma$  bonds.
- C two  $\pi$  bonds.
- D a  $\sigma$  bond and a  $\pi$  bond.

(Total for Question 2 marks)

**11** What effect does infrared radiation have on the covalent bonds in water molecules in the atmosphere?

- A** They are broken to form free radicals.
- B** They are broken into ions.
- C** The bonds vibrate more vigorously.
- D** There is no effect on the bonds.

**(Total for Question = 1 mark)**

**12** In the ethene molecule, the C=C double bond is made up of

- A** two sigma bonds.
- B** one pi bond.
- C** two pi bonds.
- D** one sigma bond and one pi bond.

**(Total for Question = 1 mark)**

**13** Which of the following statements about electronegativity is true?

- A** Non-metals have lower electronegativity than metals.
- B** Electronegativity decreases across a period in the Periodic Table.
- C** Electronegativity decreases going down a group in the Periodic Table.
- D** The bonds between atoms with equal electronegativity are always weak.

**(Total for Question = 1 mark)**

**14** In which series of compounds does the covalent character increase, going from left to right?

- A** NaCl, MgCl<sub>2</sub>, AlCl<sub>3</sub>, SiCl<sub>4</sub>
- B** SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, MgO, Na<sub>2</sub>O
- C** LiI, NaI, KI, RbI
- D** KI, KBr, KCl, KF

**(Total for Question = 1 mark)**

**15** Fullerenes, graphite and diamond are all forms of carbon. Fullerenes dissolve in petrol, but diamond and graphite do not. This is because

- A** the bonds between the carbon atoms in fullerenes are weaker than in diamond or graphite.
- B** diamond and graphite are giant structures but fullerenes are molecular.
- C** there are delocalized electrons in diamond and graphite but not in fullerenes.
- D** there are covalent bonds in diamond and graphite, but not in fullerenes.

**(Total for Question = 1 mark)**

**16** Samples of 1-chloropropane and 1-bromopropane are warmed with water containing dissolved silver nitrate in the presence of ethanol. The 1-chloropropane reacts more slowly because

- A** the C—Cl bond is more polar than the C—Br bond.
- B** the C—Cl bond is stronger than the C—Br bond.
- C** 1-chloropropane is less soluble than 1-bromopropane.
- D** 1-chloropropane is a weaker oxidizing agent than 1-bromopropane.

**(Total for Question = 1 mark)**

17 Covalent bonding results from the strong electrostatic attractions between

- A instantaneous dipoles.
- B electron clouds.
- C electrons in the bonding pair.
- D bonding pairs of electrons and nuclei.

(Total for Question 1 mark)

18 What is the total number of electrons in the covalent bonds in a beryllium chloride molecule,  $\text{BeCl}_2$ ?

- A 2
- B 4
- C 6
- D 8

(Total for Question 1 mark)

19 Which of the following molecules does **not** absorb infrared radiation?

- A  $\text{N}_2$
- B  $\text{NO}_2$
- C  $\text{CO}$
- D  $\text{CO}_2$

(Total for Question 1 mark)

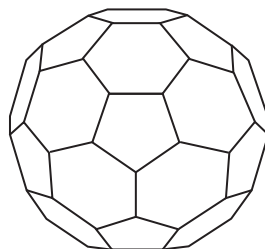


20 Which of these statements about carbon-carbon double bonds is **false**?

- A** The two ends of a molecule cannot rotate relative to each other, about the axis of the double bond.
- B** They are twice as strong as a carbon-carbon single bond.
- C** They have a higher electron density than a single bond.
- D** They consist of a sigma bond and a pi bond.

**(Total for Question = 1 mark)**

21 Buckminsterfullerene has the formula  $C_{60}$ . Its structure is shown below.



The bonding in buckminsterfullerene is similar to the bonding in graphite.

Which of the following is true?

- A All the bond angles in buckminsterfullerene are  $120^\circ$ .
- B The melting temperature of buckminsterfullerene is higher than that of graphite.
- C There are delocalized electrons in buckminsterfullerene.
- D On complete combustion, buckminsterfullerene forms carbon dioxide and water.

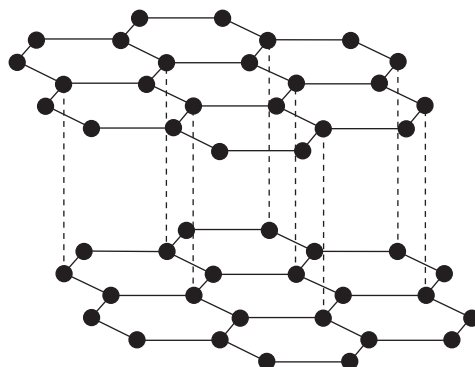
(Total for Question = 1 mark)

22 Which of the following covalent bonds is the shortest?

- A H—F
- B H—Cl
- C H—Br
- D H—I

(Total for Question = 1 mark)

23 Which of these carbon structures is represented by the diagram below?



- A Graphite
- B Diamond
- C A fullerene
- D A carbon nanotube

(Total for Question = 1 mark)

24 The bonding in **gaseous** hydrogen halides is best described as

- A mainly covalent with an increasing tendency towards ionic as you go down the group.
- B mainly covalent with an increasing tendency towards ionic as you go up the group.
- C mainly ionic with an increasing tendency towards covalent as you go down the group.
- D mainly ionic with an increasing tendency towards covalent as you go up the group.

(Total for Question = 1 mark)

25 White phosphorus consists of

- A a giant structure of atoms.
- B a giant structure of ions.
- C small molecules.
- D single atoms.

**(Total for Question = 1 mark)**

26 In propene,  $\text{CH}_2=\text{CH}-\text{CH}_3$ ,

- A the C=C double bond is longer and stronger than the C—C single bond.
- B the C=C double bond is shorter and stronger than the C—C single bond.
- C the C=C double bond is shorter and weaker than the C—C single bond.
- D the C=C double bond is longer and weaker than the C—C single bond.

**(Total for Question = 1 mark)**

27 The O—H bond in water is polar because, compared with the hydrogen atom, the oxygen atom has

- A more electrons.
- B more neutrons.
- C greater electronegativity.
- D a larger atomic radius.

**(Total for Question = 1 mark)**