

1 Which statements are correct?

- 1 The volume of a gas at constant pressure increases as the temperature increases.
- 2 The rate of diffusion of a gas increases as the temperature increases.
- 3 The pressure of a gas at constant volume decreases as the temperature increases.

A 1, 2 and 3 B 1 and 2 only C 1 and 3 only D 2 and 3 only

2 Which row shows the numbers of particles in ${}_{16}^{34}\text{S}^{2-}$?

	protons	neutrons	electrons
A	16	16	16
B	16	18	18
C	18	16	20
D	20	14	22

3 Which substance has a giant covalent structure at room temperature?

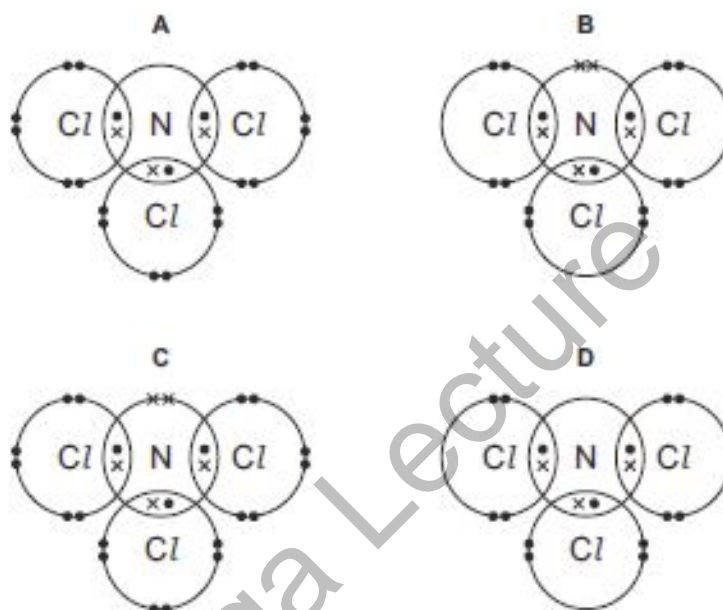
- A methane
- B sand
- C sodium chloride
- D water

- 4 Magnesium oxide has a high melting point. It is used to line the inside of furnaces that operate at high temperatures.

Why does magnesium oxide have a high melting point?

- A It has metallic bonds.
- B It has strong forces between its molecules.
- C It is a simple molecular substance.
- D It is an ionic compound.

- 5 What is the dot-and-cross diagram for NCl_3 ?



- 6 Two properties of a metal are given.

- 1 It is malleable.
- 2 It conducts electricity.

Which of these properties are due to the layers of positive ions being able to move?

- A 1 only
- B 2 only
- C both 1 and 2
- D neither 1 nor 2

- 7 Which particle contains the greatest number of electrons?

- A Mg^{2+}
- B N^{3-}
- C Ne
- D S^{2-}

- 8 One atom of element X and two atoms of element Y react to form an ionic compound. Element X forms a positive ion.

Which elements could X and Y be?

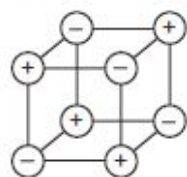
	X	Y
A	calcium	chlorine
B	calcium	oxygen
C	sodium	chlorine
D	sodium	oxygen

- 9 An element with a high melting point forms an oxide that is gaseous at room temperature.

Which type of structure or bonding is present in the element?

- A giant covalent
B ionic
C metallic
D simple molecular
- 10 Which statement explains why aluminium is malleable?
- A Aluminium has layers of cations that can slide over one another.
B Aluminium has layers of electrons that can slide over one another.
C Aluminium has weak bonds between protons and a 'sea of electrons'.
D Aluminium is covered with a layer of unreactive aluminium oxide.
- 11 Which substance would diffuse most quickly?
- A carbon dioxide at 0 °C
B carbon dioxide at 25 °C
C neon at 0 °C
D neon at 25 °C
- 12 The ion Q^{2+} has three complete shells of electrons.
What is Q?
- A calcium
B magnesium
C oxygen
D sulfur

- 13 The diagrams show the arrangement of particles in three solids: X, Y and Z. The three solids are krypton, potassium and sodium chloride.



X



Y



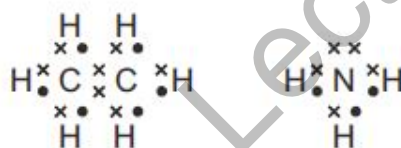
Z

Which row correctly identifies X, Y and Z?

	X	Y	Z
A	krypton	potassium	sodium chloride
B	krypton	sodium chloride	potassium
C	sodium chloride	krypton	potassium
D	sodium chloride	potassium	krypton

- 14 Ethane, C_2H_6 , and ammonia, NH_3 , are covalent compounds.

The dot-and-cross diagrams of these compounds are shown.



Which statements are correct?

- 1 A molecule of ethane contains twice as many hydrogen atoms as a molecule of ammonia.
- 2 An unreacted nitrogen atom has five outer electrons.
- 3 In a molecule of ethane, the bond between the carbon atoms is formed by sharing two electrons, one from each carbon atom.

A 1, 2 and 3 B 1 and 2 only C 1 and 3 only D 2 and 3 only

- 15 Which statement is correct?

- A All compounds are ionic.
- B All compounds conduct electricity when molten.
- C Each element only contains one type of atom.
- D In a mixture of substances, the proportions of the substances are always the same.

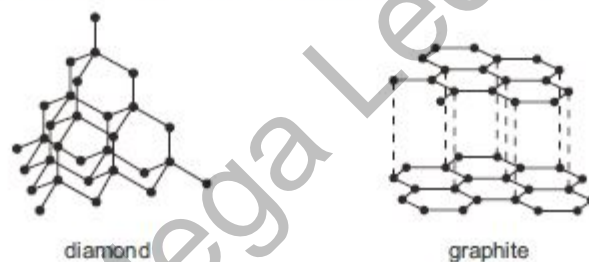
- 16 Which row describes isotopes of the same element?

	number of protons	number of neutrons
A	different	different
B	different	same
C	same	different
D	same	same

- 17 Which row describes the structure of the positive ion in sodium chloride?

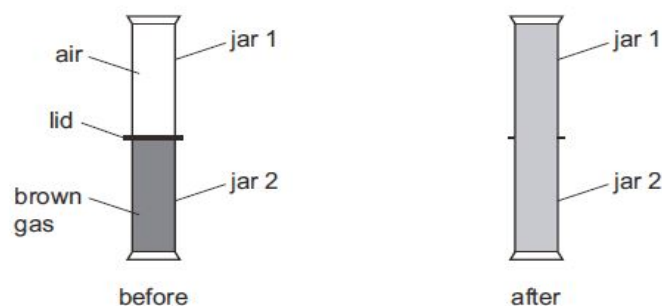
	protons	electrons	neutrons
A	11	11	12
B	11	10	12
C	17	17	18
D	17	18	18

- 18 Which pair of statements about diamond and graphite is correct?



- A Diamond and graphite are both pure carbon. They are both macromolecules.
- B Diamond and graphite can both be used as electrodes. Graphite is also used as a lubricant.
- C Diamond has covalent bonds. Graphite has ionic bonds.
- D Diamond is hard with a high melting point. Graphite is soft with a low melting point.
- 19 What is the nucleon number of an atom?
- A the number of neutrons
- B the number of protons
- C the total number of protons and neutrons
- D the total number of protons and electrons

20 Two gas jars are set up as shown.



The lid is removed and the gas jars are left to stand. After some time the contents of both gas jars are brown.

Which process causes this to happen?

- A condensation
- B diffusion
- C evaporation
- D filtration

21 In which row are the substances correctly classified?

	element	compound	mixture
A	brass	sulfur	water
B	sulfur	brass	water
C	sulfur	water	brass
D	water	sulfur	brass

22 Element Q has 4 electrons in its outer shell and has 69 neutrons. Q conducts electricity.

What is Q?

- A carbon (C)
- B lead (Pb)
- C thulium (Tm)
- D tin (Sn)

23 Which statement describes positive ions?

- A Positive ions have more electrons than neutrons.
- B Positive ions have more protons than neutrons.
- C Positive ions have more electrons than protons.
- D Positive ions have more protons than electrons.

24 The electronic structures of atoms X and Y are shown.

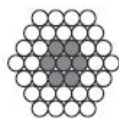


X and Y form a covalent compound.

What is its formula?

- A X_2Y
- B XY
- C XY_2
- D XY_6

- 25 The diagram shows, in cross-section, the arrangement of aluminium and steel wires in an electric power cable.



key

○ = aluminium

● = steel

Which metal wire is the better conductor and which metal wire has the greater mechanical strength?

	better conductor	greater mechanical strength
A	aluminium	aluminium
B	aluminium	steel
C	steel	aluminium
D	steel	steel

- 26 Which statement about bonding is **not** correct?

- A Carbon can form four single covalent bonds.
- B Chlorine atoms react to gain a noble gas electronic structure.
- C Covalent bonding involves losing and gaining electrons.
- D Hydrogen molecules have the formula H_2 .

27 The table shows the numbers of particles present in the nuclei of four atoms or ions.

	protons	neutrons	electronic structure
1	18	22	2,8,8
2	19	20	2,8,8
3	19	21	2,8,8,1
4	20	20	2,8,8,2

Which two particles belong to the same element?

- A** 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

28 Which substance is an ionic compound?

	volatility	electrical conductivity when molten	solubility in water
A	high	good	soluble
B	high	poor	insoluble
C	low	good	soluble
D	low	poor	insoluble

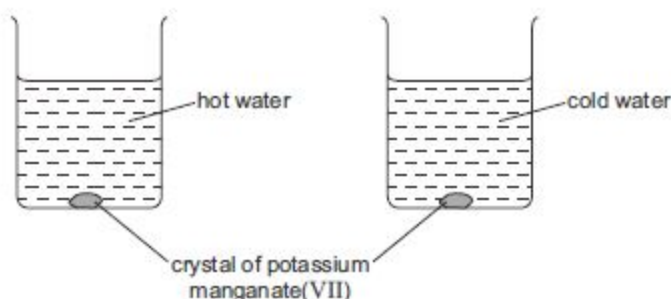
29 Covalent bonds are formed when electrons are1.....

Most covalent compounds have2..... electrical conductivity.

Which words correctly complete gaps 1 and 2?

	1	2
A	shared	high
B	shared	low
C	transferred	high
D	transferred	low

- 30 A crystal of purple potassium manganate(VII) was added to each of the beakers shown in the diagram.



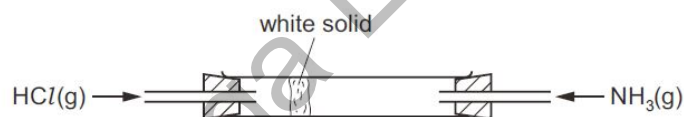
One beaker contained hot water and the other beaker contained cold water.

In both beakers the purple colour of the potassium manganate(VII) spreads out.

Which result and explanation are correct?

	result	explanation
A	colour spreads faster in cold water	particles move faster at a higher temperature
B	colour spreads faster in cold water	particles move slower at a higher temperature
C	colour spreads faster in hot water	particles move faster at a higher temperature
D	colour spreads faster in hot water	particles move slower at a higher temperature

- 31 Two gases, ammonia and hydrogen chloride, at an equal pressure, are allowed to enter the apparatus shown.



After a time, a white solid forms on the inside of the tube.

Which statements explain why a white solid forms in the position shown?

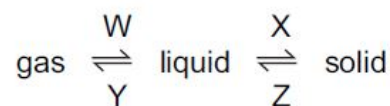
- 1 Ammonia and hydrogen chloride react to form solid ammonium chloride.
- 2 Ammonia diffuses faster than hydrogen chloride.
- 3 Ammonia has a lower relative molecular mass than hydrogen chloride.

A 1, 2 and 3 B 1 and 2 only C 1 only D 2 and 3 only

- 32 Which statement about the structure or bonding of metals is correct?

- A A metal lattice consists of atoms in a 'sea of electrons'.
- B Electrons in a metal move randomly through the lattice.
- C Metals are malleable because the particles present are mobile.
- D The ions in a metal move when positive and negative electrodes are attached.

33 In which changes do the particles move further apart?



- A** W and X **B** W and Z **C** X and Y **D** Y and Z

34 Two statements about diamond are given.

- 1 Diamond has a giant three-dimensional covalent structure of carbon atoms.
- 2 Diamond is one of the hardest substances known.

Which is correct?

- A** Both statements are correct and statement 1 explains statement 2.
B Both statements are correct but statement 2 does not explain statement 1.
C Statement 1 is correct but statement 2 is incorrect.
D Statement 2 is correct but statement 1 is incorrect.

- 35 The table shows the electronic structure of four atoms.

atom	electronic structure
W	2,8,1
X	2,8,4
Y	2,8,7
Z	2,8,8

Which two atoms combine to form a covalent compound?

- A** W and X **B** W and Y **C** X and Y **D** X and Z
- 36 An atom of element Q contains 19 electrons, 19 protons and 20 neutrons.

What is Q?

- A** calcium
B potassium
C strontium
D yttrium
- 37 Lithium is in Group I of the Periodic Table. Nitrogen is in Group V of the Periodic Table.

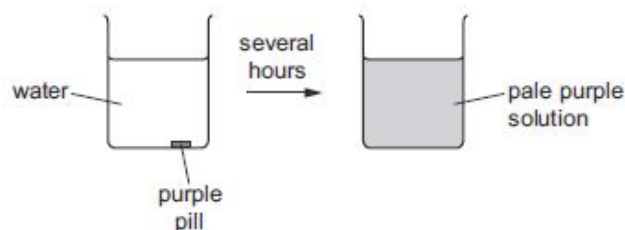
Lithium reacts with nitrogen to form the ionic compound lithium nitride.

What happens to the electrons when lithium atoms and nitrogen atoms form ions?

	lithium atoms	nitrogen atoms
A	each lithium atom loses one electron to form a Li^+ ion	each nitrogen atom gains three electrons to form an N^{3-} ion
B	each lithium atom loses one electron to form a Li^+ ion	each nitrogen atom gains five electrons to form an N^{5-} ion
C	each lithium atom gains one electron to form a Li^- ion	each nitrogen atom loses three electrons to form an N^{3+} ion
D	each lithium atom gains one electron to form a Li^- ion	each nitrogen atom loses five electrons to form an N^{5+} ion

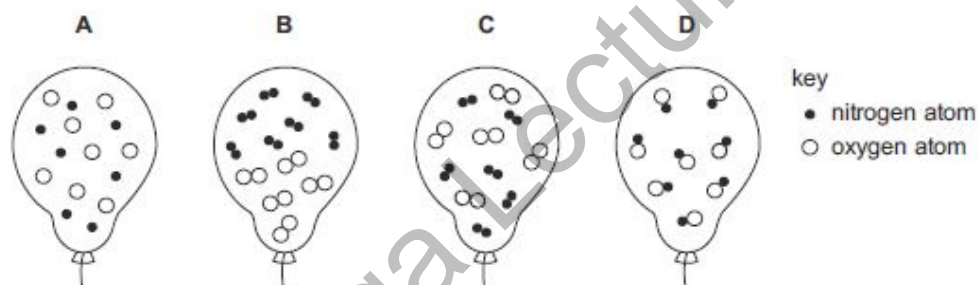
38 A purple pill is placed in a beaker of water. The beaker is left for several hours.

The diagram shows the appearance of the water when the pill is added and several hours later.



Which statement explains why this change occurs?

- A Diffusion occurs because the pill is coloured.
 - B Diffusion occurs faster at higher temperatures.
 - C Diffusion occurs from an area of high concentration to one of lower concentration.
 - D Gases diffuse faster than liquids.
- 39 Which diagram shows the arrangement of particles inside a balloon containing a mixture of the gases nitrogen and oxygen?



40 Equal masses of methane gas are stored under different conditions.

Under which set of conditions does the methane gas occupy the smallest volume?

- A 0°C and atmospheric pressure
- B 0°C and twice atmospheric pressure
- C 30°C and atmospheric pressure
- D 30°C and twice atmospheric pressure

41 A particle of an isotope of sulfur contains 18 neutrons and 18 electrons.

What is the symbol for this particle?

- A ${}_{18}^{34}\text{S}^{2+}$ B ${}_{18}^{34}\text{S}$ C ${}_{18}^{34}\text{S}^{2-}$ D ${}_{18}^{36}\text{S}$

42 When two elements react together, a compound is formed.

Which statement is correct?

- A Equal masses of the elements must be used.
B The compound shows similar chemical properties to those of the elements.
C The elements must both be non-metals.
D When the elements react together, ionic or covalent compounds form.

43 Which statement is correct for all ionic compounds?

- A They dissolve in water.
B They are formed when metals share electrons with non-metals.
C They conduct electricity in the molten state.
D They conduct electricity in the solid state.

44 When a piece of sodium is heated in air, it reacts with oxygen to form the ionic compound sodium oxide, Na_2O .

In terms of electrons, which statement correctly explains what happens when sodium reacts with oxygen?

- A An oxygen atom shares two electrons with two sodium atoms.
B A sodium atom loses two electrons which are transferred to an oxygen atom.
C A sodium atom shares its outer shell electron with two oxygen atoms.
D Two sodium atoms each lose one electron which are both transferred to one oxygen atom.

45 Which particle contains the same number of both neutrons and electrons?

- A ${}_{20}^{40}\text{Ca}^{2+}$ B ${}_{12}^{24}\text{Mg}^{2+}$ C ${}_{9}^{19}\text{F}^{-}$ D ${}_{16}^{32}\text{S}^{2-}$

46 Which statement is correct for all metals?

- A They are hard and brittle.
B They are made up of a lattice of positive and negative ions.
C They conduct electricity by movement of electrons.
D They conduct electricity by movement of ions.

47 X represents the element of atomic number 8 and Y represents the element of atomic number 19.

The two elements react together to form a compound.

Which row is correct for the compound formed?

	formula	type of bonding
A	Y_2X	covalent
B	Y_2X	ionic
C	X_2Y	covalent
D	X_2Y	ionic

48 Which statement about the particles ${}^9_9F^-$, ${}^{20}_{10}Ne$ and ${}^{23}_{11}Na^+$ is correct?

- A They all contain more electrons than protons.
- B They all contain more neutrons than protons.
- C They all contain the same number of electrons.
- D They all contain the same number of protons.

49 How many of the molecules shown contain only one covalent bond?



- A 2 B 3 C 4 D 5

50 Which substance has a giant covalent structure and contains atoms of more than one element?

- A diamond
- B graphite
- C methane
- D sand

51 Which statement correctly explains why chlorine, Cl_2 , at 40°C diffuses more slowly than neon, Ne, at 20°C ?

- A Chlorine has a relative molecular mass of 71 whilst neon has a relative atomic mass of 20.
- B Chlorine is at a higher temperature than neon.
- C Chlorine is diatomic and neon is monatomic.
- D Chlorine is more reactive than neon.

52 Metals conduct electricity.

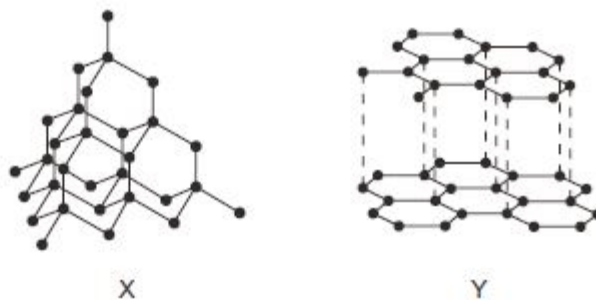
The movement of which particles is responsible for this conductivity?

- A anions
- B cations
- C electrons
- D protons

53 Which substance, when molten, conducts electricity?

- A bitumen
- B caesium iodide
- C diamond
- D sand

54 The diagrams show the structures of two forms of carbon.



Which of X and Y conduct electricity?

	X	Y
A	✓	✓
B	✓	x
C	x	✓
D	x	x

55 The table shows some properties of four substances.

Which substance is an ionic compound?

	melting point/°C	conducts electricity when solid	dissolves in water	conducts electricity in aqueous solution
A	-102	x	✓	✓
B	801	x	✓	✓
C	842	✓	✓	✓
D	3000	✓	x	x

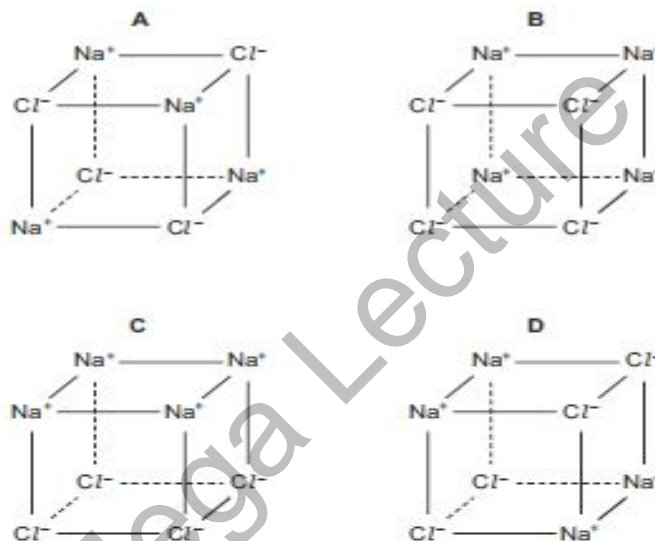
56 Some students wrote three statements about the bonding in a molecule of ammonia, NH_3 .

- 1 A nitrogen atom has three outer electrons so all outer electrons are involved in bonding.
- 2 A nitrogen atom has five outer electrons so two outer electrons are not involved in bonding.
- 3 A nitrogen atom shares electrons with each of three hydrogen atoms.

Which statements about the bonding in ammonia are correct?

- A** 1 and 3 **B** 1 only **C** 2 and 3 **D** 2 only

57 Which diagram correctly shows the arrangement of the ions in solid sodium chloride?



58 The table shows some properties of four solid elements.

Which element could be graphite?

	electrical conductivity	melting point / °C
A	good	97
B	good	3550
C	poor	113
D	poor	4750

59 Which statement about chlorine atoms and chloride ions is correct?

- A** They are both isotopes of chlorine.
- B** They undergo the same chemical reactions.
- C** They have the same number of protons.
- D** They have the same physical properties.

60 Four gases are listed.

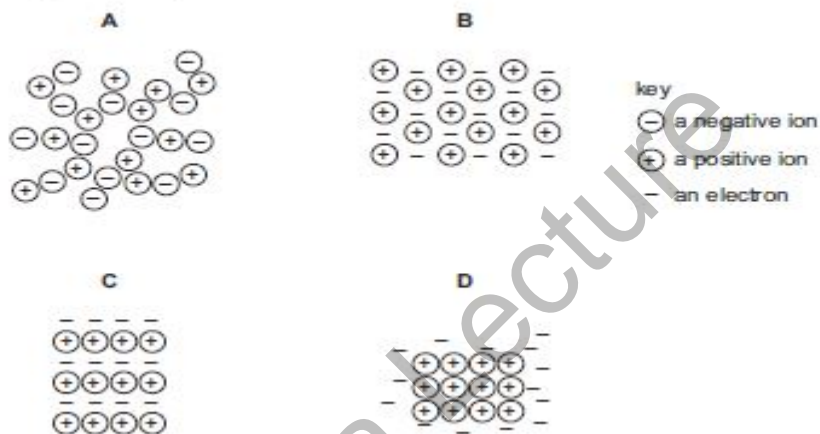
- 1 CH₄
- 2 NH₃
- 3 CO₂
- 4 N₂

1 mol/dm³ of each of gases 1 – 4 is allowed to diffuse.

What is the order of their rate of diffusion at room temperature and pressure?

	slowest	→	fastest
A	1	2	3
B	2	1	4
C	3	4	1
D	4	1	3

61 Which diagram best represents the structure of a solid metal?



Marking Key

1.B	27.C	53.B
2.B	28.C	54.C
3.B	29.B	55.B
4.D	30.C	56.C
5.C	31.A	57.A
6.A	32.B	58.B
7.D	33.D	59.C
8.A	34.A	60.C
9.A	35.C	61.B
10.A	36.B	
11.D	37.A	
12.A	38.C	
13.D	39.C	
14.A	40.B	
15.C	41.C	
16.C	42.D	
17.B	43.C	
18.A	44.D	
19.C	45.C	
20.B	46.C	
21.C	47.B	
22.D	48.C	
23.D	49.B	
24.A	50.D	
25.B	51.A	