01. 0620_w16_qp_23 Q: 4

An atom has three electron shells. There are three electrons in the outer shell.

How many protons and how many neutrons are in this atom?

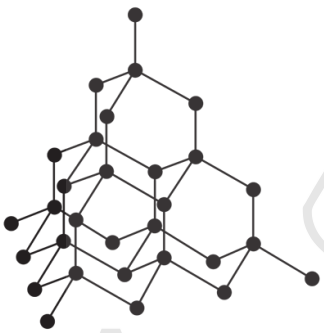
	protons	neutrons
A	13	14
B	13	27
C	14	13
D	21	24

3.2 Structure and bonding

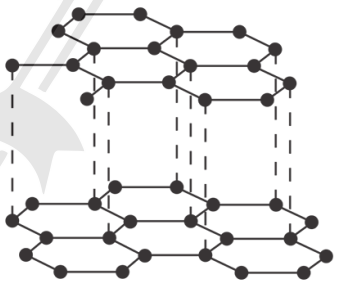
02. 0620_m21_qp_22 Q: 5

Which diagram represents the structure of silicon(IV) oxide?

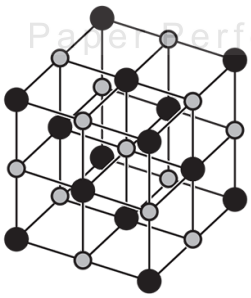
A



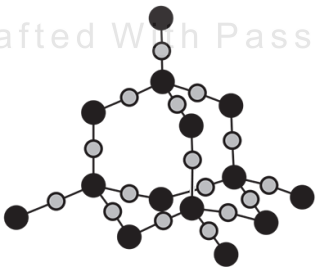
B



C



D



---

03. 0620_m21_qp_22 Q: 6

Lithium and fluorine react to form lithium fluoride.

A student writes three statements about the reaction.

1 Lithium atoms lose an electron when they react.

2 Each fluoride ion has one more electron than a fluorine atom.

3 Lithium fluoride is a mixture of elements.

Which statements are correct?

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

---

04. 0620_m21_qp_22 Q: 7

How many electrons are used to form covalent bonds in a molecule of methanol, CH_3OH?

A 5 **B** 6 **C** 8 **D** 10

---

05. 0620_m21_qp_22 Q: 8

Magnesium oxide has a high melting point.

Carbon dioxide has a low melting point.

Which row identifies the attractive forces that are broken when these compounds are melted?

	magnesium oxide	carbon dioxide
A	strong attractions between molecules	weak attractions between atoms
B	strong attractions between molecules	weak attractions between molecules
C	strong attractions between ions	weak attractions between atoms
D	strong attractions between ions	weak attractions between molecules

---

06. 0620_s21_qp_21 Q: 5

A covalent molecule Q contains only six shared electrons.

What is Q?

A ammonia, NH_3

B chlorine, Cl_2

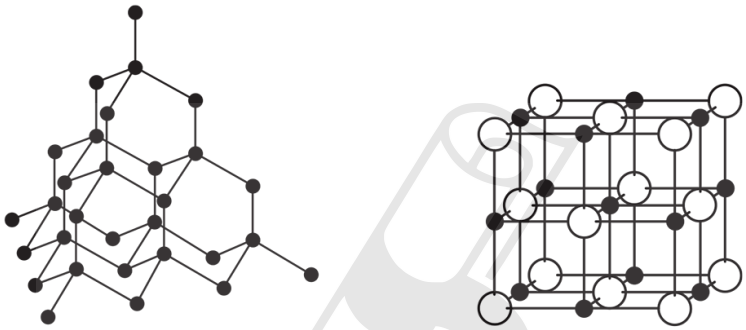
C methane, CH_4

D water, H_2O

---

07. 0620_s21_qp_21 Q: 6

The arrangement of particles in each of two solids, S and T, are shown.



S T

What are S and T?

	S	T
A	diamond	silicon(IV) oxide
B	diamond	sodium chloride
C	graphite	silicon(IV) oxide
D	graphite	sodium chloride

---

08. 0620_s21_qp_21 Q: 7

Which statement about metals is correct?

A Metals conduct electricity when molten because negative ions are free to move.

B Metals conduct electricity when solid because positive ions are free to move.

C Metals are malleable because the bonds between the atoms are weak.

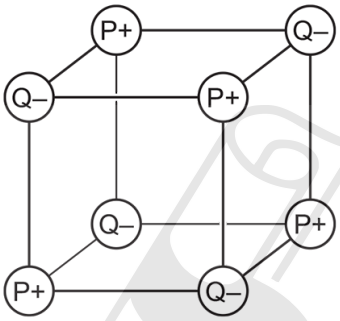
D Metals are malleable because the layers of ions can slide over each other.

---

09. 0620_s21_qp_21 Q: 8

Two elements, P and Q, are in the same period of the Periodic Table.

P and Q react together to form an ionic compound. Part of the lattice of this compound is shown.



Which statement is correct?

A An ion of P has more electrons than an ion of Q.

B Element P is non-metallic.

C P is to the left of Q in the Periodic Table.

D The formula of the compound is P_4Q_4.

---

10. 0620_s21_qp_22 Q: 5

A covalent molecule Q contains only six shared electrons.

What is Q?

A ammonia, NH_3

B chlorine, Cl_2

C methane, CH_4

D water, H_2O

---

11. 0620_s21_qp_22 Q: 6

Information about four substances E, F, G and H is shown.

	melting point / °C	electrical conductivity
E	1710	does not conduct when solid
F	3500	conducts when solid
G	120	does not conduct
H	801	conducts when molten

E, F, G and H are graphite, poly(ethene), sodium chloride and silicon(IV) oxide but not in that order.

What are E, F, G and H?

	E	F	G	H
A	graphite	poly(ethene)	silicon(IV) oxide	sodium chloride
B	sodium chloride	graphite	poly(ethene)	silicon(IV) oxide
C	poly(ethene)	sodium chloride	graphite	silicon(IV) oxide
D	silicon(IV) oxide	graphite	poly(ethene)	sodium chloride

---

12. 0620_s21_qp_22 Q: 7

Chemical compounds formed from a Group I element and a Group VII element contain ionic bonds.

How are the ionic bonds formed?

A Electrons are transferred from Group VII atoms to Group I atoms.

B Electrons are shared between Group I atoms and Group VII atoms.

C Electrons are lost by Group I atoms and Group VII atoms.

D Electrons are transferred from Group I atoms to Group VII atoms.

---

13. 0620_s21_qp_22 Q: 8

Some information about particles P, Q, R and S is shown.

	nucleon number	number of neutrons	number of electrons
P	12	6	6
Q	24	12	10
R	16	8	10
S	14	8	6

Which two particles are isotopes of the same element?

A P and Q **B** P and S **C** Q and R **D** R and S

---

14. 0620_s21_qp_23 Q: 5

A covalent molecule Q contains only six shared electrons.

What is Q?

A ammonia, NH_3

B chlorine, Cl_2

C methane, CH_4

D water, H_2O

---

15. 0620_s21_qp_23 Q: 6

Which statement explains why metals are malleable?

A The atoms release electrons to become cations.

B The electrons are free to move.

C The electrons and the cations are attracted to each other.

D The layers of ions can slide over each other.

---

16. 0620_s21_qp_23 Q: 7

Which statement about isotopes of the same element is correct?

A They have different numbers of electrons.

B They have different numbers of neutrons.

C They have different numbers of protons.

D They have the same mass number.

---

17. 0620_s21_qp_23 Q: 8

The element silicon has the same structure as diamond.

Which statement about silicon is correct?

A Every silicon atom is bonded to three other atoms only.

B Silicon has a high melting point.

C Silicon is a good conductor of electricity.

D Silicon is used as a lubricant.

---

18. 0620_s21_qp_23 Q: 20

Information about element J is shown.

- Its atoms have four electrons in their outer shell.
- It is a non-metal.
- Its oxide has a macromolecular structure.
- It has a high melting point.

What is J?

A beryllium

B carbon

C silicon

D sulfur

---

19. 0620_w21_qp_21 Q: 5

Which description of brass is correct?

A alloy

B compound

C element

D non-metal

---

20. 0620_w21_qp_21 Q: 7

Which statement describes the attractive forces between molecules?

A They are strong covalent bonds which hold molecules together.

B They are strong ionic bonds which hold molecules together.

C They are weak forces formed between covalently-bonded molecules.

D They are weak forces which hold ions together in a lattice.

---

21. 0620_w21_qp_21 Q: 8

Which statement about carbon is correct?

A Diamond and graphite both have simple molecular structures.

B Diamond and graphite are both used to make cutting tools.

C Each carbon atom in diamond is bonded to three other carbon atoms.

D Graphite conducts electricity and has a giant covalent structure.

---

22. 0620_w21_qp_22 Q: 4

How many protons, neutrons and electrons are there in one atom of the isotope $^{27}_{13}Al$?

	protons	neutrons	electrons
A	13	13	13
B	13	14	13
C	14	13	13
D	14	14	13

---

23. 0620_w21_qp_22 Q: 5

Which description of brass is correct?

A alloy

B compound

C element

D non-metal

---

24. 0620_w21_qp_22 Q: 6

Some properties of diamond are shown.

1 It is very hard.

2 Every atom forms four bonds.

3 It does not conduct electricity.

Which properties are also shown by silicon(IV) oxide?

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

---

25. 0620_w21_qp_22 Q: 7

Which statement describes the attractive forces between molecules?

A They are strong covalent bonds which hold molecules together.

B They are strong ionic bonds which hold molecules together.

C They are weak forces formed between covalently-bonded molecules.

D They are weak forces which hold ions together in a lattice.

---

26. 0620_w21_qp_22 Q: 8

Which substance is described as a macromolecule?

A ammonia

B graphite

C iron

D sodium chloride

---

27. 0620_w21_qp_23 Q: 5

Which description of brass is correct?

A alloy

B compound

C element

D non-metal

---

28. 0620_w21_qp_23 Q: 6

A Group I element combines with a Group VII element and forms an ionic bond.

Which row shows how the electronic structures change?

	Group I element		Group VII element	
	before bonding	after bonding	before bonding	after bonding
A	2,8,1	2,8,2	2,7	2,6
B	2,8	2,7	2,8	2,8,1
C	2,8,1	2,8	2,7	2,8
D	2,8	2,8,1	2,8	2,7

---

29. 0620_w21_qp_23 Q: 7

Which statement describes the attractive forces between molecules?

A They are strong covalent bonds which hold molecules together.

B They are strong ionic bonds which hold molecules together.

C They are weak forces formed between covalently-bonded molecules.

D They are weak forces which hold ions together in a lattice.

---

30. 0620_w21_qp_23 Q: 8

Which diagram shows the outer electron arrangement in a molecule of carbon dioxide?

A

B

C

D

---

31. 0620_w21_qp_23 Q: 9

Aluminium oxide is an ionic compound containing Al^{3+} ions and O^{2-} ions.

Aluminium hydroxide is an ionic compound containing Al^{3+} ions and OH^- ions.

In which row are the formulae for aluminium oxide and aluminium hydroxide correct?

	aluminium oxide	aluminium hydroxide
A	Al_2O_3	$Al(OH)_3$
B	Al_3O_2	$AlOH_3$
C	Al_2O_3	$AlOH_3$
D	Al_3O_2	$Al(OH)_3$

---

32. 0620_m20_qp_22 Q: 4

Lithium reacts with fluorine to form the compound lithium fluoride.

Which statement about this reaction is correct?

A Each fluorine atom gains one electron.

B Each fluorine atom gains two or more electrons.

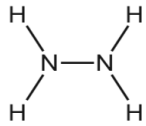
C Each fluorine atom loses one electron.

D Each fluorine atom loses two or more electrons.

---

33. 0620_m20_qp_22 Q: 6

The molecular structure of hydrazine, N_2H_4, is shown.



Which description of the bonding in hydrazine is **not** correct?

A Each nitrogen atom has a non-bonding pair of electrons.

B Each nitrogen atom has four bonding pairs of electrons.

C Each nitrogen atom shares one of its electrons with a nitrogen atom.

D Each nitrogen atom shares two of its electrons with hydrogen atoms.

---

34. 0620_m20_qp_22 Q: 7

Solid X has a high boiling point.

Its structure has positive ions surrounded by a sea of electrons.

Which other properties does solid X have?

A brittle and an electrical conductor

B brittle and an insulator

C malleable and an electrical conductor

D malleable and an insulator

---

35. 0620_p20_qp_20 Q: 4

The table shows the structure of different atoms and ions.

particle	proton number	nucleon number	number of protons	number of neutrons	number of electrons
Mg	12	24	12	W	12
Mg^{2+}	X	24	12	12	10
F	9	19	9	Y	9
F^-	9	19	9	10	Z

What are the values of W, X, Y and Z?

	W	X	Y	Z
A	10	10	9	9
B	10	12	10	9
C	12	10	9	10
D	12	12	10	10

---

36. 0620_p20_qp_20 Q: 5

Iron is a metal. The structure of iron is described as a lattice of positive ions in a sea of electrons.

Which of the following statements about iron are correct?

1 iron conducts electricity because the electrons are free to move

2 iron has a high melting point due to the strong covalent bonds

3 iron is an alloy

4 iron is malleable because the layers of atoms can slide over one another

A 1 only

B 1 and 3

C 1 and 4

D 2, 3 and 4

---

37. 0620_p20_qp_20 Q: 6

Which two elements react together to form an ionic compound?

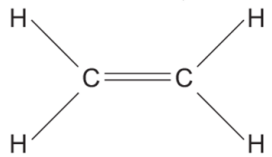
element	electronic structure
R	2,4
T	2,8
X	2,8,1
Z	2,8,7

A R and T **B** T and X **C** X and Z **D** Z and R

---

38. 0620_p20_qp_20 Q: 7

Ethene is an unsaturated hydrocarbon.



Which description of the bonding in ethene is correct?

A All atoms in the molecule have a share of eight electrons.

B Each carbon atom shares two of its electrons with hydrogen atoms and two of its electrons with a carbon atom.

C Each carbon atom shares two of its electrons with hydrogen atoms and one of its electrons with a carbon atom.

D The two carbon atoms share a total of six electrons with other atoms.

---

39. 0620_s20_qp_21 Q: 4

The atomic number and nucleon number of a potassium atom are shown.

	potassium atom
atomic number	19
nucleon number	39

How many protons, neutrons and electrons are in a potassium ion, K^+?

	protons	neutrons	electrons
A	19	20	18
B	19	20	20
C	20	19	18
D	20	19	19

---

40. 0620_s20_qp_21 Q: 5

The electronic structures of two atoms, P and Q, are shown.

P and Q combine together to form a compound.

What is the type of bonding in the compound and what is the formula of the compound?

	type of bonding	formula
A	ionic	PQ
B	ionic	PQ_2
C	covalent	PQ_2
D	covalent	PQ

---

41. 0620_s20_qp_21 Q: 6

Which row contains a description of metallic bonding and a property that is explained by reference to metallic bonding?

	description of metallic bonding	property explained by metallic bonding
A	a lattice of negative ions in a sea of electrons	a metal will react with an acid, producing hydrogen
B	a lattice of negative ions in a sea of electrons	a piece of a metal can be moulded into different shapes
C	a lattice of positive ions in a sea of electrons	a metal will react with an acid, producing hydrogen
D	a lattice of positive ions in a sea of electrons	a piece of a metal can be moulded into different shapes

---

42. 0620_s20_qp_21 Q: 7

Which statement explains why methane has a lower boiling point than water?

A Methane has weaker covalent bonds than water.

B Methane has weaker attractive forces than water.

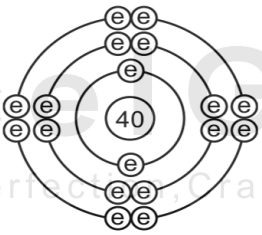
C Methane molecules are heavier than water molecules.

D Methane molecules have more bonds than water molecules.

---

43. 0620_s20_qp_22 Q: 4

The diagram shows the electronic structure of a particle with a nucleon number (mass number) of 40.



The table shows the suggestions that three students, 1, 2 and 3, made to identify the particle.

	student		
	1	2	3
particle	Ar	Cl	Ca^{2+}

Which students are correct?

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

---

44. 0620_s20_qp_22 Q: 6

Which statement about the structure of a metal explains why metals are malleable?

A The electrons can move freely throughout the lattice.

B The layers of metal ions can slide over each other.

C The metal ions are positively charged.

D There is a strong force of attraction between the metal ions and the electrons.

---

45. 0620_s20_qp_22 Q: 7

The bonding, structure and melting point of sodium chloride and sulfur dichloride are shown.

compound	bonding	structure	melting point / °C
sodium chloride	ionic	giant lattice	801
sulfur dichloride	covalent	simple molecular	–121

Why does sulfur dichloride have a lower melting point than sodium chloride?

A The covalent bonds in sulfur dichloride are weaker than the attractive forces between molecules in sodium chloride.

B The covalent bonds in sulfur dichloride are weaker than the ionic bonds in sodium chloride.

C The attractive forces between molecules in sulfur dichloride are weaker than the attractive forces between molecules in sodium chloride.

D The attractive forces between molecules in sulfur dichloride are weaker than the ionic bonds in sodium chloride.

---

46. 0620_s20_qp_23 Q: 6

Caesium is a metal in Group I of the Periodic Table.

Which description of the bonding in caesium is correct?

A electrostatic attraction between oppositely charged ions

B electrostatic attraction between positive metal ions and mobile electrons

C neighbouring metal atoms sharing pairs of electrons

D strong attractive forces between atoms

---

47. 0620_s20_qp_23 Q: 7

Why does magnesium oxide, MgO, have a very high melting point?

A There is a very strong double bond between magnesium and oxygen.

B There is a very strong attractive force between the magnesium oxide molecules.

C The oxide ions are strongly attracted to positive ions.

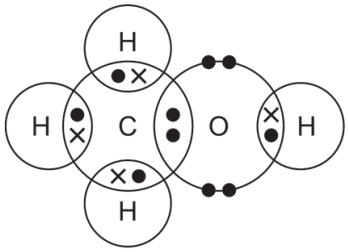
D The magnesium ions are strongly attracted to a sea of electrons.

---

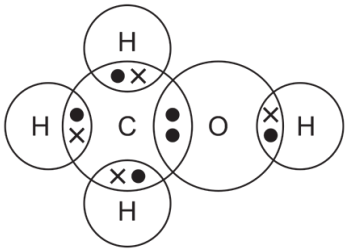
48. 0620_w20_qp_21 Q: 7

Which diagram shows the outer shell electron arrangement in a molecule of methanol, CH_3OH?

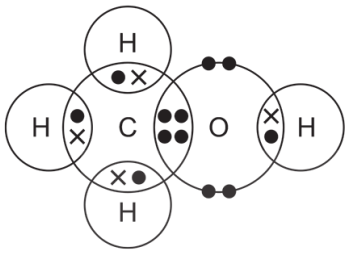
A



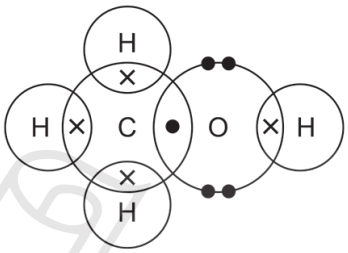
B



C



D



---

49. 0620_w20_qp_21 Q: 8

Which statement about silicon dioxide, SiO_2, is correct?

A It conducts electricity because it contains free electrons.

B It is a macromolecule with four oxygen atoms bonded to each silicon atom.

C It is a simple covalent molecule.

D Its structure is similar to graphite.

---

50. 0620_w20_qp_21 Q: 9

Rubidium is in Group I of the Periodic Table and bromine is in Group VII.

Rubidium reacts with bromine to form an ionic compound.

Which row shows the electron change taking place for rubidium and the correct formula of the rubidium ion?

	electron change	formula of ion formed
A	electron gained	Rb^+
B	electron gained	Rb^-
C	electron lost	Rb^+
D	electron lost	Rb^-

---

51. 0620_w20_qp_21 Q: 10

Which statement explains why graphite is used as a lubricant?

A All bonds between the atoms are weak.

B It conducts electricity.

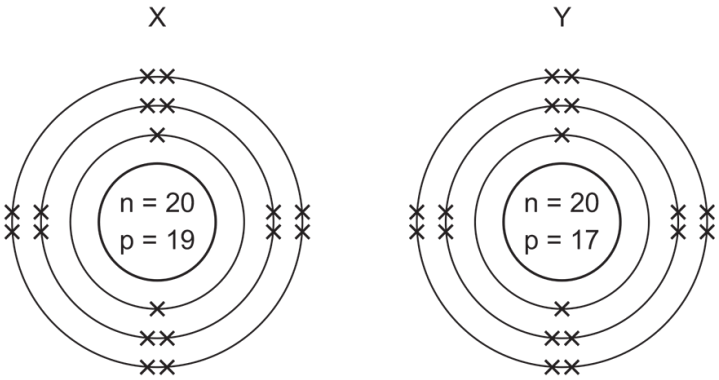
C It has a low melting point.

D Layers in the structure can slide over each other.

---

52. 0620_w20_qp_22 Q: 6

The arrangements of the electrons in two ions formed from elements X and Y are shown.



Which equation represents the reaction between elements X and Y?

A $X_2 + 2Y \rightarrow 2X^+ + 2Y^-$

B $X_2 + 2Y \rightarrow 2X^- + 2Y^+$

C $2X + Y_2 \rightarrow 2X^+ + 2Y^-$

D $2X + Y_2 \rightarrow 2X^- + 2Y^+$

---

53. 0620_w20_qp_22 Q: 7

Which row identifies compounds that contain single covalent bonds only, double covalent bonds only or both single and double covalent bonds?

	single covalent bonds only	double covalent bonds only	both single and double covalent bonds
A	C_2H_4	CH_3OH	CO_2
B	CH_3OH	C_2H_4	CO_2
C	CH_3OH	CO_2	C_2H_4
D	CO_2	C_2H_4	CH_3OH

---

54. 0620_w20_qp_22 Q: 10

Which statement explains why graphite is used as a lubricant?

A All bonds between the atoms are weak.

B It conducts electricity.

C It has a low melting point.

D Layers in the structure can slide over each other.

---

55. 0620_w20_qp_23 Q: 5

Molecules containing only non-metal atoms are covalently bonded.

The formulae of four covalently bonded molecules are given below:

1 nitrogen, N_2

2 carbon dioxide, CO_2

3 ethene, C_2H_4

4 methanol, CH_3OH

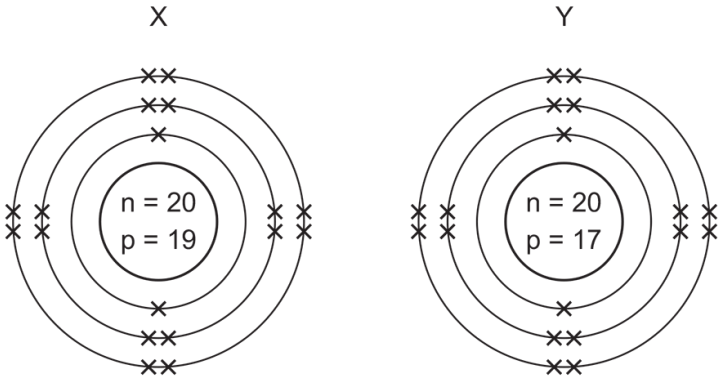
Which of the molecules contain double bonds?

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

---

56. 0620_w20_qp_23 Q: 6

The arrangements of the electrons in two ions formed from elements X and Y are shown.



Which equation represents the reaction between elements X and Y?

A $X_2 + 2Y \rightarrow 2X^+ + 2Y^-$

B $X_2 + 2Y \rightarrow 2X^- + 2Y^+$

C $2X + Y_2 \rightarrow 2X^+ + 2Y^-$

D $2X + Y_2 \rightarrow 2X^- + 2Y^+$

---

57. 0620_w20_qp_23 Q: 7

Magnesium reacts with sulfuric acid.

What are the formulae of the products formed in this reaction?

A $MgSO_4$ and H_2

B $MgSO_4$ and H_2O

C $Mg(SO_4)_2$ and H_2

D $Mg(SO_4)_2$ and H_2O

---

58. 0620_w20_qp_23 Q: 8

Sodium reacts with chlorine to form sodium chloride.

Which row describes the bonding in the three substances?

	sodium	chlorine	sodium chloride
A	covalent	covalent	covalent
B	covalent	metallic	ionic
C	metallic	covalent	ionic
D	metallic	metallic	covalent

---

59. 0620_w20_qp_23 Q: 9

Rubidium is in Group I of the Periodic Table and bromine is in Group VII.

Rubidium reacts with bromine to form an ionic compound.

Which row shows the electron change taking place for rubidium and the correct formula of the rubidium ion?

	electron change	formula of ion formed
A	electron gained	Rb^+
B	electron gained	Rb^-
C	electron lost	Rb^+
D	electron lost	Rb^-

---

60. 0620_w20_qp_23 Q: 10

Which statement explains why graphite is used as a lubricant?

A All bonds between the atoms are weak.

B It conducts electricity.

C It has a low melting point.

D Layers in the structure can slide over each other.

---

61. 0620_m19_qp_22 Q: 6

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

---

62. 0620_m19_qp_22 Q: 7

Which statement about copper, diamond and silicon(IV) oxide is correct?

A Copper and silicon(IV) oxide have similar electrical conductivity.

B In diamond the carbon atoms are covalently bonded as flat sheets.

C In silicon(IV) oxide the silicon and oxygen atoms are covalently bonded as flat sheets.

D The structure of copper includes a lattice of positive ions.

---

63. 0620_s19_qp_21 Q: 5

Which row describes the formation of single covalent bonds in methane?

A	atoms share a pair of electrons	both atoms gain a noble gas electronic structure
B	atoms share a pair of electrons	both atoms have the same number of electrons in their outer shell
C	electrons are transferred from one atom to another	both atoms gain a noble gas electronic structure
D	electrons are transferred from one atom to another	both atoms have the same number of electrons in their outer shell

---

64. 0620_s19_qp_21 Q: 6

Which statement describes the structure of an ionic compound?

A It is a giant lattice of oppositely charged ions.

B It is a giant lattice of positive ions in a ‘sea’ of electrons.

C It is a giant molecule of oppositely charged ions.

D It is a simple molecule of oppositely charged ions.

---

65. 0620_w19_qp_21 Q: 4

Which statement about an ionic compound is **not** correct?

A It conducts electricity when dissolved in water.

B It has a high melting point due to strong attractive forces between ions.

C It has a regular lattice of oppositely charged ions in a 'sea of electrons'.

D The ionic bonds are formed between metallic and non-metallic elements.

---

66. 0620_w19_qp_21 Q: 7

How are the structures of diamond and silicon(IV) oxide similar?

A Molecules of both diamond and silicon(IV) oxide are held together by weak attractive forces.

B They both contain atoms arranged in planes held together by weak bonds.

C They both contain ions that are free to move.

D The carbon in diamond and the silicon in silicon(IV) oxide each have four covalent bonds.

---

67. 0620_w19_qp_21 Q: 8

Which statement describes the structure of copper?

A It has a lattice of negative ions in a 'sea of electrons'.

B It has a lattice of negative ions in a 'sea of protons'.

C It has a lattice of positive ions in a 'sea of electrons'.

D It has a lattice of positive ions in a 'sea of protons'.

---

68. 0620_w19_qp_22 Q: 7

Which statement about the structure and properties of silicon(IV) oxide is **not** correct?

A It has a giant structure similar to that of diamond.

B It has a high melting point due to the strong attractive force between molecules.

C There are strong covalent bonds between silicon and oxygen.

D There are no free electrons, so silicon(IV) oxide does not conduct electricity.

---

69. 0620_w19_qp_23 Q: 7

Silicon(IV) oxide is a covalently bonded compound.

Which statements are correct?

1 Silicon atoms form four single bonds in silicon(IV) oxide.

2 Oxygen atoms form two double bonds in silicon(IV) oxide.

3 Silicon(IV) oxide has a high melting point.

4 Silicon(IV) oxide contains one silicon atom and four oxygen atoms.

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

---

70. 0620_m18_qp_22 Q: 4

Caesium, Cs, is an element in Group I of the Periodic Table.

When caesium reacts it forms a positive ion, Cs^+.

How is a caesium ion formed?

A A caesium atom gains a proton.

B A caesium atom gains an electron.

C A caesium atom loses an electron.

D A caesium atom shares an electron.

---

71. 0620_m18_qp_22 Q: 5

The structure of copper is described as a lattice of positive ions in a 'sea of electrons'.

Which statements are correct?

1 Copper has a high melting point because of the strong electrostatic attraction between the positive ions and the 'sea of electrons'.

2 Copper is malleable because the layers of atoms in the lattice can slide over each other.

3 Copper atoms can be oxidised to form copper ions by losing electrons.

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

---

72. 0620_m18_qp_22 Q: 6

Three statements about diamond, graphite and silicon(IV) oxide are listed.

1 Diamond and graphite both have giant covalent structures.

2 In silicon(IV) oxide, silicon and oxygen atoms are joined together by covalent bonds throughout the whole structure.

3 Diamond and silicon(IV) oxide have similar structures.

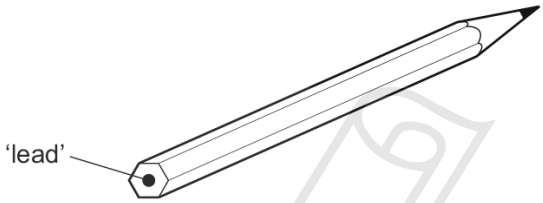
Which statements are correct?

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

---

73. 0620_s18_qp_21 Q: 4

The 'lead' in a pencil is made of a mixture of graphite and clay.



When the percentage of graphite is increased, the pencil slides across the paper more easily.

Which statement explains this observation?

A Graphite has a high melting point.

B Graphite is a form of carbon.

C Graphite is a lubricant.

D Graphite is a non-metal.

---

74. 0620_s18_qp_21 Q: 6

Which substance is **not** a macromolecule?

A diamond

B graphite

C silicon(IV) oxide

D sulfur

---

75. 0620_s18_qp_21 Q: 7

Copper is a metallic element.

Which statements about copper are correct?

1 Copper is malleable because layers of ions are in fixed positions and cannot move.

2 The structure of copper consists of negative ions in a lattice.

3 Copper conducts electricity because electrons can move through the metal.

4 Electrons hold copper ions together in a lattice by electrostatic attraction.

A 1 and 2 **B** 2, 3 and 4 **C** 2 and 3 only **D** 3 and 4 only

---

76. 0620_s18_qp_22 Q: 6

Which substances have similar structures?

A diamond and graphite

B diamond and silicon(IV) oxide

C graphite and poly(ethene)

D graphite and silicon(IV) oxide

---

77. 0620_s18_qp_23 Q: 6

How many silicon atoms are bonded to each oxygen atom in a crystal of silicon(IV) oxide?

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

---

78. 0620_w18_qp_21 Q: 6

Which statement describes the lattice structure of a metal?

A The lattice consists of alternating positive ions and negative ions.

B The lattice consists of neutral atoms arranged in layers.

C The lattice consists of positive ions in a 'sea of electrons'.

D The lattice consists of neutral atoms in a 'sea of electrons'.

---

79. 0620_w18_qp_22 Q: 5

How many electrons are used to form covalent bonds in a molecule of methanol, CH_3OH?

A 5 **B** 6 **C** 8 **D** 10

---

80. 0620_w18_qp_22 Q: 6

Potassium bromide and methanol are both compounds.

Their melting points are different.

Which row is correct?

	substance with the higher melting point	reason why the melting points are different
A	methanol	the attractive forces between oppositely charged ions is greater than the attractive forces between molecules
B	methanol	the attractive forces between molecules is greater than the attractive forces between oppositely charged ions
C	potassium bromide	the attractive forces between oppositely charged ions is greater than the attractive forces between molecules
D	potassium bromide	the attractive forces between molecules is greater than the attractive forces between oppositely charged ions

---

81. 0620_w18_qp_23 Q: 5

Which covalent molecule contains two atoms bonded together by exactly four shared electrons?

A N_2 **B** C_3H_8 **C** CH_3OH **D** CH_3COOH

---

82. 0620_w18_qp_23 Q: 6

The formula of ammonia is NH_3.

Which statement about a molecule of ammonia is correct?

A The bonding in a molecule of ammonia is ionic.

B The nitrogen atom has a noble gas configuration, the hydrogen atoms do not.

C The nitrogen atom shares all of its electrons with hydrogen atoms.

D There are six shared electrons in a molecule of ammonia.

---

83. 0620_m17_qp_22 Q: 5

The formulae of some ions are shown.

positive ions	negative ions
Al^{3+}	Br^-
Ca^{2+}	CO_3^{2-}
Cu^{2+}	NO_3^-
Fe^{3+}	S^{2-}
K^+	SO_4^{2-}

In which row is the formula **not** correct?

	compound	formula
A	aluminium sulfate	$Al_2(SO_4)_3$
B	calcium nitrate	$Ca(NO_3)_2$
C	iron(III) bromide	Fe_3Br
D	potassium sulfide	K_2S

---

84. 0620_m17_qp_22 Q: 6

Diamond and silicon(IV) oxide both have giant structures.

Which statements are correct?

1 Both substances are compounds.

2 There are strong covalent bonds in diamond.

3 Silicon(IV) oxide is bonded ionically.

4 Both substances have very high melting points.

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

---

85. 0620_m17_qp_22 Q: 7

Which statement about metals is correct?

A Layers of positive ions can slide over each other making metals malleable.

B Metallic bonding consists of a lattice of negative ions in a sea of delocalised electrons.

C Metallic bonding consists of a lattice of positive ions in a sea of delocalised negative ions.

D Metals conduct electricity because positive ions are free to move.

---

86. 0620_s17_qp_21 Q: 4

Sodium reacts with chlorine to form sodium chloride.

Which statements describe what happens to the sodium atoms in this reaction?

1 Sodium atoms form positive ions.

2 Sodium atoms form negative ions.

3 Sodium atoms gain electrons.

4 Sodium atoms lose electrons.

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

---

87. 0620_s17_qp_21 Q: 5

Diamond is extremely hard and does not conduct electricity.

Which statement explains these properties?

A It has a lattice of positive carbon ions in a 'sea of electrons'.

B It has delocalised electrons and each carbon atom forms three covalent bonds with other carbon atoms.

C It has no delocalised electrons and each carbon atom forms four covalent bonds with other carbon atoms.

D It has strong ionic bonds between each carbon atom.

---

88. 0620_s17_qp_21 Q: 6

Which statement about metals is **not** correct?

A Metals are malleable because the metal ions can slide over one another.

B Metals conduct electricity because electrons can move through the lattice.

C Metals consist of a giant lattice of metal ions in a 'sea of electrons'.

D Metals have high melting points because of the strong attraction between the metal ions.

---

89. 0620_s17_qp_22 Q: 4

Which element does **not** form a stable ion with the same electronic structure as argon?

A aluminium

B chlorine

C phosphorus

D potassium

---

90. 0620_s17_qp_22 Q: 5

Graphite and diamond are both forms of the element carbon.

Which row shows the number of other carbon atoms that each carbon atom is covalently bonded to in graphite and diamond?

	graphite	diamond
A	3	3
B	3	4
C	4	3
D	4	4

---

91. 0620_s17_qp_22 Q: 6

Which statement describes metallic bonding?

A The attraction between a lattice of negative ions and delocalised protons.

B The attraction between a lattice of positive ions and delocalised electrons.

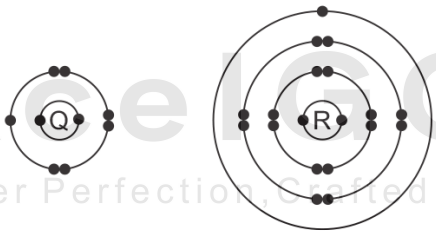
C The attraction between delocalised protons and electrons.

D The attraction between oppositely charged ions.

---

92. 0620_s17_qp_23 Q: 4

The electronic structures of atoms Q and R are shown.



Q and R form an ionic compound.

What is the formula of the compound?

A QR_7 **B** Q_2R_4 **C** QR **D** Q_7R

---

93. 0620_s17_qp_23 Q: 5

Which substance is a macromolecule?

A ammonia

B carbon dioxide

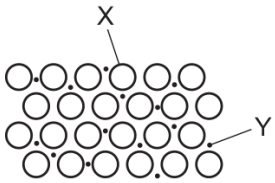
C diamond

D water

---

94. 0620_s17_qp_23 Q: 6

The diagram shows metallic bonding.



Which labels are correct?

	X	Y
A	atomic nucleus	outer electron
B	metal atom	mobile electron
C	metal ion	mobile electron
D	positive ion	negative ion

---

95. 0620_w17_qp_21 Q: 4

Two statements about silicon(IV) oxide are given.

1 It is a hard substance.

2 It has a macromolecular structure with strong covalent bonds.

Which is correct?

A Both statements are correct and statement 2 explains statement 1.

B Both statements are correct but statement 2 does not explain statement 1.

C Statement 1 is correct but statement 2 is not correct.

D Statement 2 is correct but statement 1 is not correct.

---

96. 0620_w17_qp_21 Q: 6

Which dot-and-cross diagram shows the outer shell electron arrangement in a molecule of nitrogen?

A 

B 

C 

D 

---

97. 0620_w17_qp_22 Q: 4

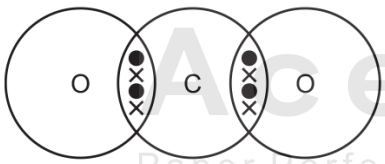
Which row describes silicon(IV) oxide?

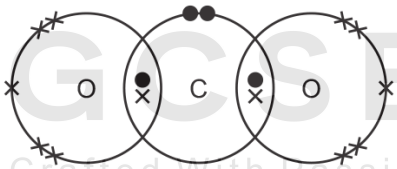
	has a giant structure	is an acidic oxide	conducts electricity
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✗
D	✗	✓	✓

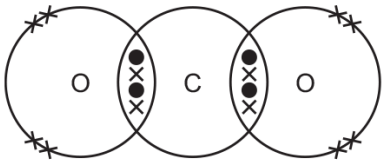
---

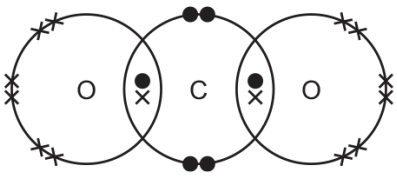
98. 0620_w17_qp_22 Q: 6

Which dot-and-cross diagram shows the outer shell electron arrangement in a molecule of carbon dioxide?

A 

B 

C 

D 

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99. 0620_w17_qp_23 Q: 4

Which compound is silicon(IV) oxide?

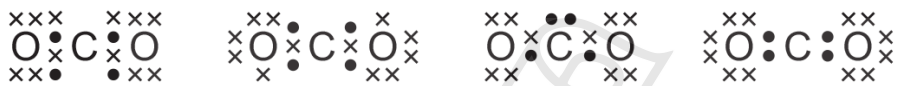
	melting point /°C	good electrical conductor when solid	good electrical conductor when molten
A	–73	no	no
B	801	no	yes
C	1495	yes	yes
D	1710	no	no

---

100. 0620_w17_qp_23 Q: 6

Which dot-and-cross diagram shows the outer shell electron arrangement in a molecule of carbon dioxide?

A **B** **C** **D**



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101. 0620_m16_qp_22 Q: 4

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

---

102. 0620_m16_qp_22 Q: 5

Which molecule contains only single covalent bonds?

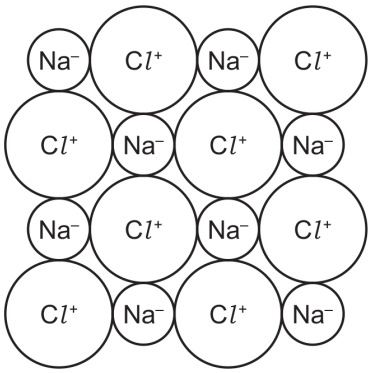
A Cl_2 **B** CO_2 **C** N_2 **D** O_2

---

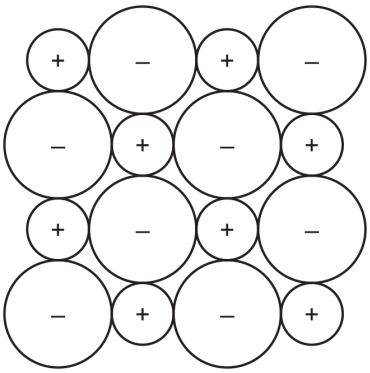
103. 0620_m16_qp_22 Q: 6

Which structure represents the sodium chloride lattice?

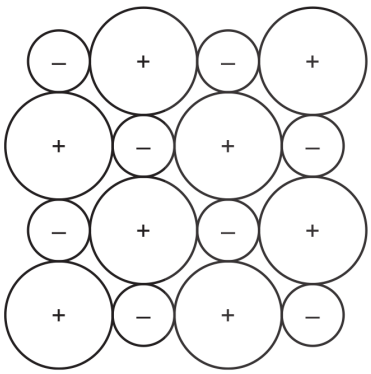
A



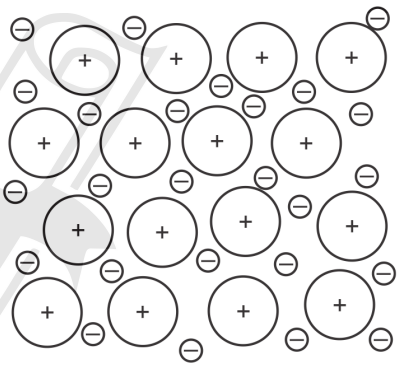
B



C



D



104. 0620_p16_qp_20 Q: 4

The table shows the structure of different atoms and ions.

particle	proton number	nucleon number	number of protons	number of neutrons	number of electrons
Mg	12	24	12	W	12
Mg^{2+}	X	24	12	12	10
F	9	19	9	Y	9
F^-	9	19	9	10	Z

What are the values of W, X, Y and Z?

	W	X	Y	Z
A	10	10	9	9
B	10	12	10	9
C	12	10	9	10
D	12	12	10	10

---

105. 0620_p16_qp_20 Q: 5

Iron is a metal. The structure of iron is described as a lattice of positive ions in a sea of electrons.

Which of the following statements about iron are correct?

1 iron conducts electricity because the electrons are free to move

2 iron has a high melting point due to the strong covalent bonds

3 iron is an alloy

4 iron is malleable because the layers of atoms can slide over one another

A 1 only

B 1 and 3

C 1 and 4

D 2, 3 and 4

---

106. 0620_p16_qp_20 Q: 6

Which two elements react together to form an ionic compound?

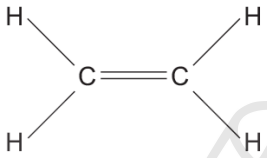
element	electronic structure
R	2,4
T	2,8
X	2,8,1
Z	2,8,7

A R and T **B** T and X **C** X and Z **D** Z and R

---

107. 0620_p16_qp_20 Q: 7

Ethene is an unsaturated hydrocarbon.



Which description of the bonding in ethene is correct?

A All atoms in the molecule have a share of eight electrons.

B Each carbon atom shares two of its electrons with hydrogen atoms and two of its electrons with a carbon atom.

C Each carbon atom shares two of its electrons with hydrogen atoms and one of its electrons with a carbon atom.

D The two carbon atoms share a total of six electrons with other atoms.

---

108. 0620_s16_qp_21 Q: 5

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

---

109. 0620_s16_qp_21 Q: 6

Which statement describes the attractive forces between molecules (intermolecular forces)?

A They are strong covalent bonds which hold molecules together.

B They are strong ionic bonds which hold molecules together.

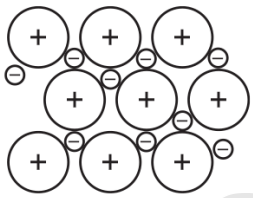
C They are weak forces formed between covalently-bonded molecules.

D They are weak forces which hold ions together in a lattice.

---

110. 0620_s16_qp_21 Q: 7

The diagram represents the general structure of a solid Z.



What is Z?

A aluminium

B iodine

C silicon dioxide

D sulfur

---

111. 0620_s16_qp_22 Q: 7

Metals consist of a lattice of positive ions in a 'sea of electrons'.

Why is aluminium malleable?

A Its ions are attracted to the 'sea of electrons'.

B Its ions are tightly packed together.

C Its ions repel each other.

D Its layers of ions can slide over each other.

---

112. 0620_s16_qp_23 Q: 7

Which substance exists as a lattice of positive ions in a 'sea of electrons'?

A liquid potassium chloride

B solid graphite

C solid magnesium

D solid silicon(IV) oxide

---

113. 0620_w16_qp_21 Q: 5

Metal P reacts with non-metal Q to form a compound.

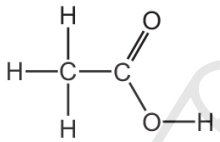
Which process takes place and which type of compound is formed?

	process	type of compound
A	electrons are transferred from P to Q	covalent
B	electrons are transferred from P to Q	ionic
C	electrons are transferred from Q to P	covalent
D	electrons are transferred from Q to P	ionic

---

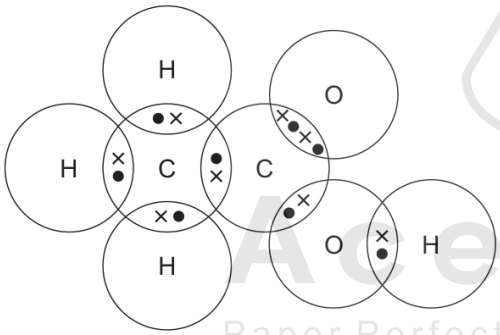
114. 0620_w16_qp_21 Q: 6

The structure of ethanoic acid is shown.

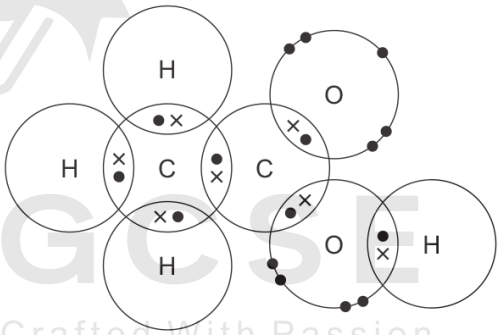


Which diagram shows the arrangement of outer shell electrons in a molecule of ethanoic acid?

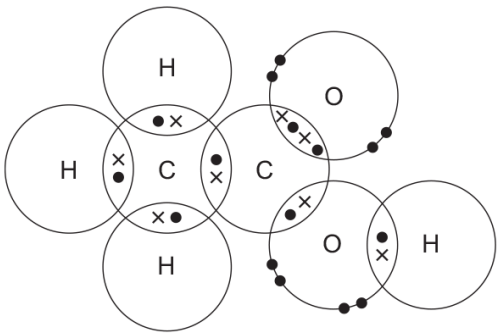
A



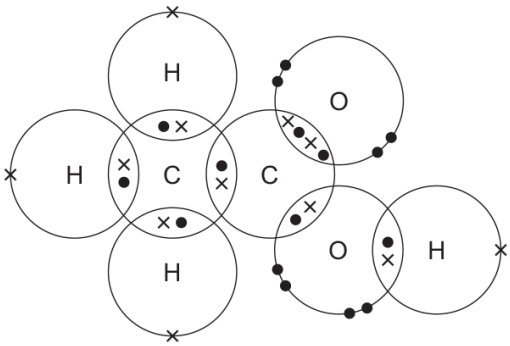
B



C



D



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115. 0620_w16_qp_21 Q: 7

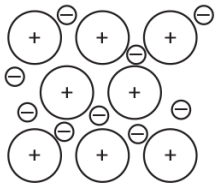
X is a solid at room temperature.

X has a high melting point.

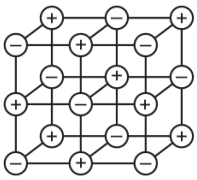
Solid X conducts electricity.

Which diagram shows how the particles are arranged in solid X?

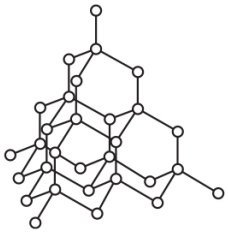
A



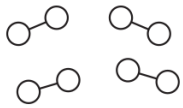
B



C



D



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116. 0620_w16_qp_22 Q: 5

In which ionic compound do the metal ion and the non-metal ion have the same electronic structure?

A CaO **B** KBr **C** MgO **D** NaC*l*

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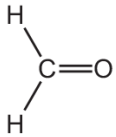
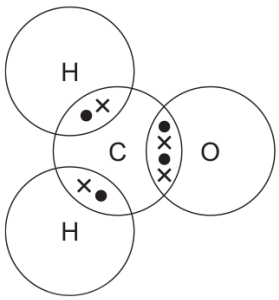
117. 0620_w16_qp_22 Q: 6

The structure of methanal is shown.

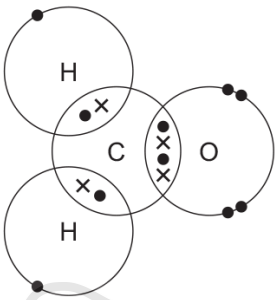


Which diagram shows the arrangement of outer shell electrons in a molecule of methanal?

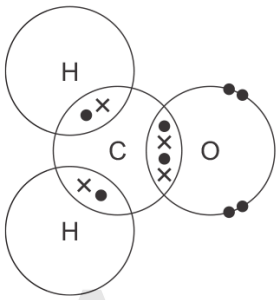
A



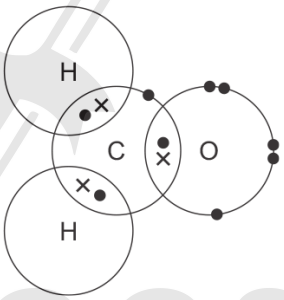
B



C



D



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118. 0620_w16_qp_22 Q: 7

Iron is a metal. Its structure consists of a giant lattice of positive ions in a 'sea of electrons'.

Which statements about solid iron are correct?

1 Iron conducts electricity because the electrons are free to move.

2 Iron conducts heat because the positive ions are free to move.

3 Iron has a high melting point due to the strong covalent bonds.

4 Iron is malleable because the layers of ions can slide over one another.

A 1 and 3 **B** 1 and 4 **C** 1 only **D** 2, 3 and 4

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119. 0620_w16_qp_23 Q: 5

Ethanol is a liquid at room temperature and boils at 78 °C.

Sodium chloride is a solid at room temperature.

Which statement about the bonding in ethanol and sodium chloride is **not** correct?

A Each ethanol molecule is held together by weak covalent bonds.

B The ethanol molecules are held together by weak attractive forces.

C The sodium ions and chloride ions are held together by strong attractive forces.

D The sodium ions and chloride ions are held together in a giant lattice.

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120. 0620_w16_qp_23 Q: 6

The molecules N_2, C_2H_4, CO_2 and CH_3OH all have covalent bonds.

These bonds consist of shared pairs of electrons.

Which row gives the total number of shared pairs of electrons in the molecules shown?

	molecule	total number of shared pairs of electrons
A	N_2	2
B	C_2H_4	6
C	CO_2	2
D	CH_3OH	4

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121. 0620_w16_qp_23 Q: 7

Metals are malleable.

Which statement explains why metals are malleable?

A Metallic bonding is very strong.

B Metals are good conductors of electricity.

C Positive metal ions are arranged in a regular lattice structure.

D The layers of positive metal ions can slide over each other.

SN	Paper	Q. No.	Answer
01	0620_w16_qp_23	4	A
02	0620_m21_qp_22	5	D
03	0620_m21_qp_22	6	A
04	0620_m21_qp_22	7	D
05	0620_m21_qp_22	8	D
06	0620_s21_qp_21	5	A
07	0620_s21_qp_21	6	B
08	0620_s21_qp_21	7	D
09	0620_s21_qp_21	8	C
10	0620_s21_qp_22	5	A
11	0620_s21_qp_22	6	D
12	0620_s21_qp_22	7	D
13	0620_s21_qp_22	8	B
14	0620_s21_qp_23	5	A
15	0620_s21_qp_23	6	D
16	0620_s21_qp_23	7	B
17	0620_s21_qp_23	8	B
18	0620_s21_qp_23	20	C
19	0620_w21_qp_21	5	A
20	0620_w21_qp_21	7	C
21	0620_w21_qp_21	8	D
22	0620_w21_qp_22	4	B
23	0620_w21_qp_22	5	A
24	0620_w21_qp_22	6	C
25	0620_w21_qp_22	7	C
26	0620_w21_qp_22	8	B
27	0620_w21_qp_23	5	A
28	0620_w21_qp_23	6	C
29	0620_w21_qp_23	7	C
30	0620_w21_qp_23	8	A
31	0620_w21_qp_23	9	A
32	0620_m20_qp_22	4	A
33	0620_m20_qp_22	6	B
34	0620_m20_qp_22	7	C
35	0620_p20_qp_20	4	D
36	0620_p20_qp_20	5	C
37	0620_p20_qp_20	6	C
38	0620_p20_qp_20	7	B
39	0620_s20_qp_21	4	A
40	0620_s20_qp_21	5	A
41	0620_s20_qp_21	6	D
42	0620_s20_qp_21	7	B
43	0620_s20_qp_22	4	B
44	0620_s20_qp_22	6	B
45	0620_s20_qp_22	7	D
46	0620_s20_qp_23	6	B
47	0620_s20_qp_23	7	C
48	0620_w20_qp_21	7	A
49	0620_w20_qp_21	8	B

SN	Paper	Q. No.	Answer
50	0620_w20_qp_21	9	C
51	0620_w20_qp_21	10	D
52	0620_w20_qp_22	6	C
53	0620_w20_qp_22	7	C
54	0620_w20_qp_22	10	D
55	0620_w20_qp_23	5	B
56	0620_w20_qp_23	6	C
57	0620_w20_qp_23	7	A
58	0620_w20_qp_23	8	C
59	0620_w20_qp_23	9	C
60	0620_w20_qp_23	10	D
61	0620_m19_qp_22	6	B
62	0620_m19_qp_22	7	D
63	0620_s19_qp_21	5	A
64	0620_s19_qp_21	6	A
65	0620_w19_qp_21	4	C
66	0620_w19_qp_21	7	D
67	0620_w19_qp_21	8	C
68	0620_w19_qp_22	7	B
69	0620_w19_qp_23	7	B
70	0620_m18_qp_22	4	C
71	0620_m18_qp_22	5	A
72	0620_m18_qp_22	6	A
73	0620_s18_qp_21	4	C
74	0620_s18_qp_21	6	D
75	0620_s18_qp_21	7	D
76	0620_s18_qp_22	6	B
77	0620_s18_qp_23	6	B
78	0620_w18_qp_21	6	C
79	0620_w18_qp_22	5	D
80	0620_w18_qp_22	6	C
81	0620_w18_qp_23	5	D
82	0620_w18_qp_23	6	D
83	0620_m17_qp_22	5	C
84	0620_m17_qp_22	6	C
85	0620_m17_qp_22	7	A
86	0620_s17_qp_21	4	B
87	0620_s17_qp_21	5	C
88	0620_s17_qp_21	6	D
89	0620_s17_qp_22	4	A
90	0620_s17_qp_22	5	B
91	0620_s17_qp_22	6	B
92	0620_s17_qp_23	4	C
93	0620_s17_qp_23	5	C
94	0620_s17_qp_23	6	C
95	0620_w17_qp_21	4	A
96	0620_w17_qp_21	6	B
97	0620_w17_qp_22	4	B
98	0620_w17_qp_22	6	C

SN	Paper	Q. No.	Answer
99	0620_w17_qp_23	4	D
100	0620_w17_qp_23	6	A
101	0620_m16_qp_22	4	C
102	0620_m16_qp_22	5	A
103	0620_m16_qp_22	6	B
104	0620_p16_qp_20	4	D
105	0620_p16_qp_20	5	C
106	0620_p16_qp_20	6	C
107	0620_p16_qp_20	7	B
108	0620_s16_qp_21	5	C
109	0620_s16_qp_21	6	C
110	0620_s16_qp_21	7	A
111	0620_s16_qp_22	7	D
112	0620_s16_qp_23	7	C
113	0620_w16_qp_21	5	B
114	0620_w16_qp_21	6	C
115	0620_w16_qp_21	7	A
116	0620_w16_qp_22	5	C
117	0620_w16_qp_22	6	C
118	0620_w16_qp_22	7	B
119	0620_w16_qp_23	5	A
120	0620_w16_qp_23	6	B
121	0620_w16_qp_23	7	D