

Bonding :

Q1. (2018)

9 Which statement about **covalent** bonding is true?

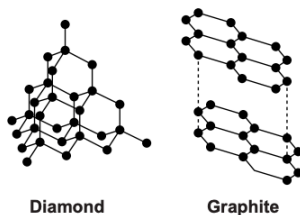
- A Electrons are transferred from one atom to another.
- B Electrons are delocalised.
- C Electrons are shared between atoms.
- D Ions are formed.

Your answer

[1]

Q2. (2018)

21 The diagrams show the structures of diamond and graphite.



One property of diamond is that it is very hard. One property of graphite is that it is slippery.

(A)

(b) Describe the type of bonding between the carbon atoms in diamond.

..... [1]

(B)

(c) Graphite is slippery.

Use the structure of graphite to explain why.

.....
..... [2]

Q3. (2018)

Q6. (2019)

7 Which substance has **ionic** bonding?

- A Carbon dioxide
- B Carbon monoxide
- C Magnesium oxide
- D Oxygen

Your answer ☐

[1]

Q7. (2019)

13 The molecular formula of hydrogen peroxide is H_2O_2 .

What is the **empirical formula** of hydrogen peroxide?

- A H_2O_2
- B H_2O
- C HO
- D H_2O_4

Your answer ☐

[1]

Q8. (2019)

15 The formula of a magnesium ion is Mg^{2+} .

The formula of a nitrate ion is NO_3^- .

What is the formula of **magnesium nitrate**?

- A MgNO_3
- B Mg_2NO_3
- C $\text{Mg}(\text{NO}_3)_2$
- D $\text{Mg}_2(\text{NO}_3)_3$

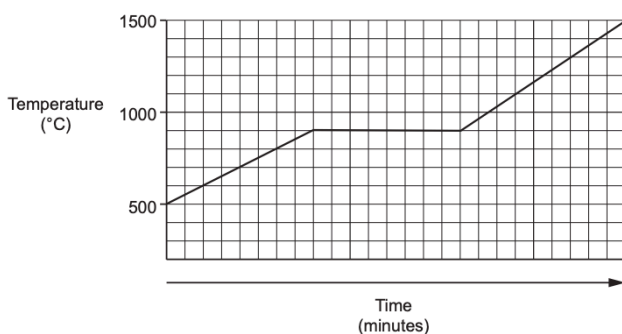
Your answer ☐

[1]

Q9. (2019)

17 A new solid, compound **X**, has been discovered. Scientists investigated the effect of heat on compound **X**.

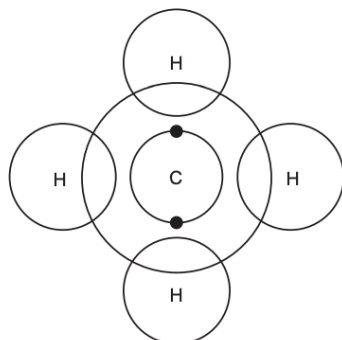
Look at the graph. It shows how the state of compound **X** changes as it is heated.



(A)

- (i) Carbon reacts with hydrogen to make methane, CH_4 .

Complete the dot and cross diagram to show the bonding in methane.



[2]

(ii)

- (ii) Methane has a low melting point.

Explain why methane has a low melting point.

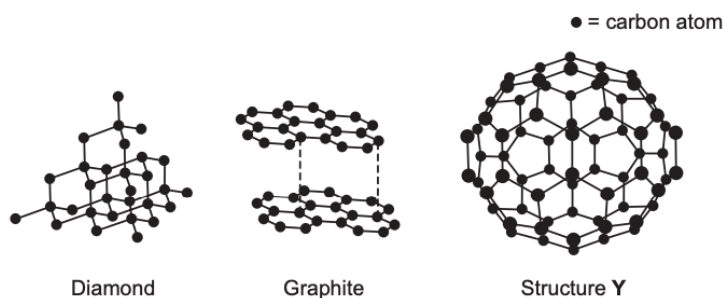
Use ideas about structure and bonding in your answer.

.....

 [2]

Q11. (2019)

- 20 The diagrams show three different structures of carbon.



(B)

(i)

- (i) Diamond is the hardest naturally occurring substance on Earth.

Explain why diamond is hard.

.....
 [2]

(ii)

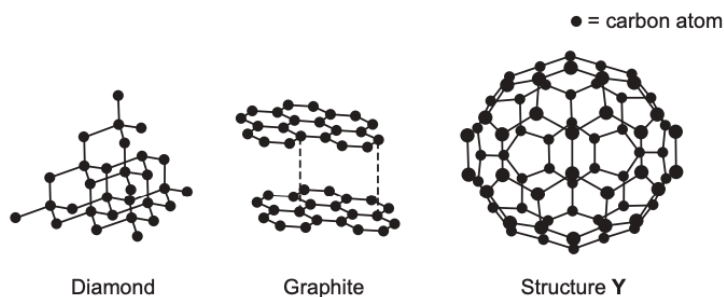
- (ii) Graphite is used in pencils. Graphite is a soft material.

Explain why graphite is soft.

.....
 [1]

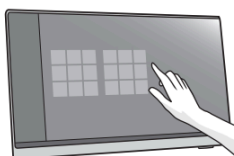
Q12. (2019)

20 The diagrams show three different structures of carbon.



(A)

- (c) Graphene is another substance made of carbon atoms. Graphene is a single layer of graphite. It is just one atom thick. Graphene can be used to make touchscreens for electronic devices.



Look at the table. It shows some properties of graphite and graphene.

Substance	Cost	Electrical conductivity	Density	Strength	Colour
Graphite	low	high	low	low	black
Graphene	high	high	low	high	transparent

Explain why **graphene** is suitable for making touchscreens.

Use the information from the table.

.....

 [2]

Q13. (2019)

22 Lithium is a metal found in Group 1 of the Periodic Table.

(A)

(i)

- (i) Describe the structure and bonding in a metal.

You may include a diagram in your answer.

.....

 [2]

(ii)

- (ii) Lithium is **malleable** even though metallic bonds are strong.

Explain why metals are malleable.

.....
 [1]

(iii)

- (iii) Lithium can conduct electricity in the solid and liquid state.

Explain why metals can conduct electricity.

.....

 [2]

Q14. (2020)

- 14 The symbol of an aluminium ion is Al^{3+} .

The symbol of an oxide ion is O^{2-} .

What is the formula of aluminium oxide?

- A AlO
 B Al_2O
 C Al_3O_2
 D Al_2O_3

Your answer

[1]

Q15. (2020)

22 This question is about structure and bonding.

(A)

- (a) Look at the two structures, **A** and **B**, in Fig. 22.1.

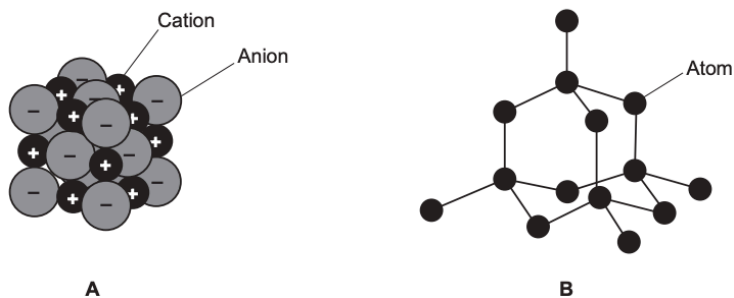


Fig. 22.1

(i)

Identify the bonding in structure **A**.

Explain your answer.

Bonding
 Explanation
 [2]

(ii)

Explain why structure **B** has a high melting point.

.....
.....
..... [2]

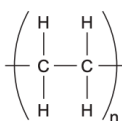
(iii)

Explain why structure **B** does **not** conduct electricity.

.....
..... [1]

Q16. (2021)

6 The structure of poly(ethene) is shown.



Which type of structure does poly(ethene) have?

- A Giant covalent
- B Ionic
- C Metal
- D Polymer

Your answer ☐

[1]

Q17. (2021)

10 Which statement describes the bonding in **iron**?

- A Cross-links between the chains are strong.
- B Electrons are shared between atoms.
- C Electrons are transferred between atoms, forming ions.
- D Positive ions are surrounded by a "sea" of delocalised electrons.

Your answer ☐

[1]

Q18. (2021)

13 Which substance has **covalent** bonding?

- A Aluminium
- B Carbon dioxide
- C Magnesium
- D Sodium chloride

Your answer ☐

[1]

Q19. (2021)

21 Molecules can be shown using different diagrams or models.

The table shows a diagram and a model of ammonia, NH_3 .

Molecule	Dot and cross diagram	3-D space filling model
Ammonia, NH_3		

(A)

(a)* Describe the **advantages** and **limitations** of these two different ways of showing a molecule of ammonia.

[6]

Q20. (2021)

22 The table shows carbon can exist as several different structures called allotropes.

Allotrope	Covalent bonds
Diamond	
Graphite	
Graphene	3

(A)

(a) Complete the table to show how many covalent bonds carbon forms in these allotropes. [2]

(B)

(i)

(i) Diamond can be used as a cutting tool because it is so hard.

Explain why diamond is so hard.

Use ideas about structure and bonding in diamond in your answer.

[2]

. [2]

(ii)

- (ii) Graphite can be used as a lubricant because it is slippery.

Explain why graphite is slippery.

Use ideas about structure and bonding in graphite in your answer.

.....

.....

..... [2]

(C)

- (c) Explain why carbon forms many other compounds. Use ideas about the bonding in carbon compounds in your answer.

.....

.....

..... [2]

Q21. (2021)

23 The table shows information about some properties of four substances.

Substance	Melting point (°C)	Boiling point (°C)	Solubility in water	Does the substance conduct electricity?
M	−98	65	Soluble	No
N	−114	78	Soluble	No
O	661	1304	Soluble	Only when molten or dissolved
P	1085	2562	Insoluble	Yes

(A)

- (c) Draw lines to connect each substance with its correct type of structure and bonding.

Substance M	Giant Covalent
Substance O	Ionic
Substance P	Metallic
	Polymer
	Simple Covalent

[3]

Q22. (2022)

3 Which substance has **four** covalent bonds to each carbon atom?

- A Carbon nanotubes
- B Diamond
- C Graphene
- D Graphite

Your answer

[1]

Q23. (2022)

- 8 The symbol for a calcium ion is Ca^{2+} . The symbol for an iodate ion is IO_3^- .

What is the formula for calcium iodate?

- A CaIO_3
 B CaIO_{32}
 C $\text{Ca}(\text{IO}_3)_2$
 D Ca_2IO_3

Your answer

[1]

Q24. (2022)

- 18 The table shows data about four different substances.

Substance	Melting point ($^{\circ}\text{C}$)	Boiling point ($^{\circ}\text{C}$)	Soluble in water?	Conducts electricity as a solid?	Conducts electricity when molten or dissolved?
A	550	1300	yes	no	yes
B	-183	-162	no	no	no
C	420	907	no	yes	yes
D	1670	>1670	no	no	no

A scientist uses the information to find out what type of bonding is present in each substance.

(A)

(i)

- (i) The scientist thinks substance **A** is an **ionic** compound.

Explain why the scientist is correct.

.....

 [2]

(ii)

- (ii) Which of the substances is a **simple covalent** compound?

Explain your answer.

Substance

Reason 1

Reason 2 [3]

(iii)

- (iii) What is the state of substance **B** at room temperature?

Put a ring around the correct answer.

Solid

Liquid

Gas

[1]

(B)

- (b) The scientist investigates some metals and metal alloys.

(i)

- (i) Describe the structure and bonding in a metal.

You can include a labelled diagram in your answer.

.....
.....
.....
.....
..... [3]

(ii)

- (ii) Explain why metals are malleable.

.....
..... [1]

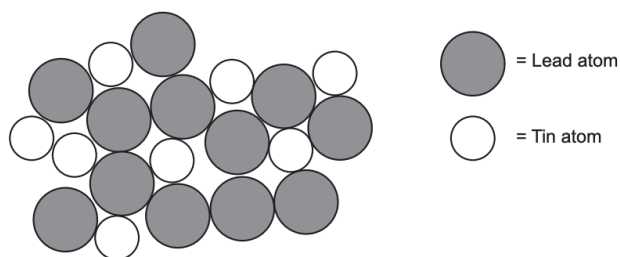
(iii)

- (iii) Explain why metals can conduct electricity.

.....
.....
..... [2]

(iv)

- (iv) The scientist has a diagram of one type of metal alloy as shown.



What is the smallest ratio of lead to tin in the alloy?

Ratio of lead to tin = ... [2]

(v)

- (v) The table shows data about other alloys made from tin, copper and silver.

	Alloy 1	Alloy 2	Alloy 3
Tin content (%)	95.5	99.0	96.5
Copper content (%)	0.7	0.7	0.5
Silver content (%)	3.8	0.3	3.0
Melting point (°C)	217	227	220

What is the relationship between the silver content and the melting point?

.....
 [1]

Q25. (2024)

- 4 Sodium chloride, NaCl , is an ionic compound.

How are the ions held together in sodium chloride?

- A Covalent bonds
- B Delocalised electrons
- C Electrostatic forces
- D Intermolecular forces

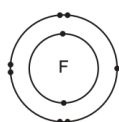
Your answer ☐

[1]

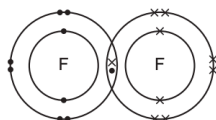
Q26. (2024)

- 9 Which dot and cross diagram shows the structure of a fluorine molecule, F_2 ?

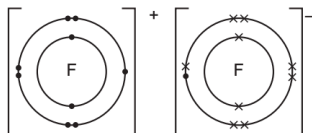
A



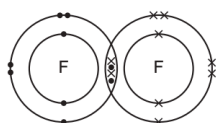
B



C



D



Your answer ☐

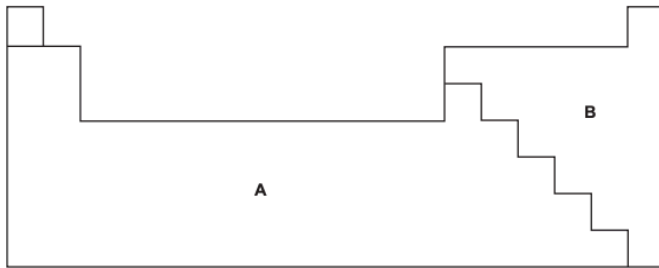
[1]

Q27. (2024)

(A)

20

(a)* A Periodic Table is shown with two sections, **A** and **B**.



An element, **X**, is shiny and conducts electricity.

State and explain if element **X** is found in section **A** or **B**.

In your answer, describe the differences in the **physical** properties of elements in sections **A** and **B**.

[6]

.. [6]

(B)

(b) In his Periodic Table, Mendeleev noticed that when elements were arranged in order of atomic mass, some elements seemed to be in the wrong place.

Complete the sentences about Mendeleev's Periodic Table.

Use words from the list.

had the wrong mass	left gaps for	neutrons	properties
reweighed	were undiscovered		

Mendeleev grouped the elements according to their

He predicted that some elements

He these elements.

[3]

(C)

(c) Lithium is in Group 1 of the Periodic Table and helium is in Group 0.



Explain why Group 1 elements are reactive, but Group 0 elements are unreactive.

.....

.....

.....

..... [2]