CrackingCHEM

GCSE | A-LEVEL

UNDERSTAND • APPLY • SUCCEED

OCR A H432

Bonding I

Original exam questions | TEST IT → EXAM STYLE → HARDER MIXED → STRETCH

SPECIFICATION-LED. PROGRESSIVE. EXAM-FOCUSED.

OCR A SPECIFICATION	2.1.2(a) | 2.2.2(a-f,n-o) | linked 3.1.1(d-f)

TEST IT	EXAM STYLE	HARDER MIXED	STRETCH
8	10	5	1

24 ORIGINAL QUESTIONS **166 TOTAL MARKS**

FINAL NOTES-ALIGNED EDITION | FORMULAE • BONDING • STRUCTURE • PROPERTIES

Independent practice material. Every question is original and stays within the finished OCR A Bonding I notes.

START HERE

How to use this pack

Define precisely, prove electron origin, then build every property explanation as a chain

1. Complete TEST IT without the notes. Correct weak definitions before moving on.
2. For every diagram, check electron origin, electron totals, brackets and charges.
3. For every property, write structure → particles → attraction → energy or mobility → property.
4. Use the marks to count distinct points. Do not replace precise particles with vague words such as things or particles.

✓ **OCR A boundary:** This pack covers 2.1.2(a), 2.2.2(a-f,n-o) and only the Bonding I foundation links in 3.1.1(d-f). Shapes, bond angles, electronegativity, polarity, detailed intermolecular forces and the full silicon/graphene Periodicity treatment are excluded.

Definition discipline: Electron transfer forms ions. The ionic bond is the electrostatic attraction between the resulting oppositely charged ions. A covalent definition must name the shared pair and both nuclei.

Diagram standard: Use dots and crosses consistently. Ionic diagrams require square brackets and charges. Dative arrows start at the donated electron pair and point to the acceptor.

Property route: Start with the structure, name the particles and attraction, then state the energy needed or whether charged particles are mobile.

Notes alignment: All questions map directly to the final CrackingChem OCR A Bonding I notes and the current OCR A H432 specification.

THE FIVE-LINK PROPERTY ROUTE

STRUCTURE	PARTICLES	ATTRACTION	ENERGY / MOBILITY	PROPERTY
giant or simple	ions, atoms, molecules or electrons	name it precisely	overcome it or move charge	state the observed result

SECTION A

TEST IT

Eight direct checks of the finished-notes mastery outcomes

QUESTION 1 | TEST IT

Complete the table of OCR A ions.

Ion name	Formula and charge
nitrate	
carbonate	
sulfate	
hydroxide	
ammonium	
zinc	
silver	

[7 marks]

QUESTION 2 | TEST IT

Write the formula of each compound. Every formula must be neutral and in the smallest whole-number ratio.

Compound	Formula [6 marks]
aluminium oxide	
calcium nitrate	
ammonium sulfate	
magnesium hydroxide	
zinc carbonate	
silver nitrate	

(g) State when brackets are required around a compound ion.

.....

[1 mark]

QUESTION 3 | TEST IT

(a) State the precise OCR A definition of ionic bonding.

[2 marks]

(b) Explain why electron transfer is not itself the ionic bond.

[2 marks]

QUESTION 4 | TEST IT

Draw a dot-and-cross diagram for magnesium chloride, $MgCl_2$. Show outer-shell electrons only, electron origin, square brackets, charges and complete outer shells.

DIAGRAM SPACE

[5 marks]

QUESTION 5 | TEST IT

(a) State the precise OCR A definition of a covalent bond.

[3 marks]

(b) State the number of shared electron pairs in H_2, O_2 and N_2.

[2 marks]

QUESTION 6 | TEST IT

Draw complete dot-and-cross diagrams for HCl, O_2 and N_2. Show all shared pairs and all lone pairs.

THREE MODEL DIAGRAMS

[7 marks]

QUESTION 7 | TEST IT

(a) State what is meant by a dative covalent bond.

[2 marks]

(b) For $NH_3 + H^+ \rightarrow NH_4^+$, name the electron-pair donor and acceptor and state the arrow direction.

[2 marks]

(c) Draw the ammonium ion, showing the origin of the electron pair in the newly formed bond, square brackets and overall charge.

DIAGRAM SPACE

[2 marks]

QUESTION 8 | TEST IT

(a) State the precise definition of metallic bonding.

[2 marks]

(b) Bond X has an average bond enthalpy of 436 kJ mol^{-1} and bond Y has 598 kJ mol^{-1}. Identify the stronger bond and justify your choice.

[1 mark]

SECTION B

EXAM STYLE

Ten original structured questions using OCR A bonding and structure conventions

✓ **Route check:** Name the structure, particles and attraction before discussing energy or mobility.

QUESTION 9 | EXAM STYLE

Sodium chloride forms a giant ionic lattice.

(a) Explain why sodium chloride has a high melting point.

[2 marks]

(b) Explain why solid sodium chloride does not conduct electricity but molten sodium chloride does.

[3 marks]

(c) Explain why aqueous sodium chloride conducts electricity.

[1 mark]

(d) Write one careful sentence about the solubility of ionic compounds in water.

[1 mark]

QUESTION 10 | EXAM STYLE

Sodium forms Na^+ ions and oxygen forms O^{2-} ions.

(a) Deduce the formula of sodium oxide.

.....

[1 mark]

(b) Draw a complete electron-origin diagram for sodium oxide. Show all ions, brackets, charges and outer-shell electrons.

DIAGRAM SPACE

[6 marks]

QUESTION 11 | EXAM STYLE

Carbon dioxide, CO_2, contains two carbon-oxygen double bonds.

(a) State the total number of shared electron pairs in one CO_2 molecule.

[1 mark]

(b) Draw a complete dot-and-cross diagram for CO_2. Show electron origin and all lone pairs.

DIAGRAM SPACE

[6 marks]

QUESTION 12 | EXAM STYLE

A water molecule reacts with H^+ to form H_3O^+.

(a) Identify the electron-pair donor and acceptor and state the direction of the dative-bond arrow.

[3 marks]

(b) Draw the H_3O^+ ion, showing the origin of the electron pair in the dative bond, brackets and charge.

DIAGRAM SPACE

[3 marks]

QUESTION 13 | EXAM STYLE

Average bond enthalpy data are shown: C–C 347 kJ mol^{-1}; H–H 436 kJ mol^{-1}; C=C 612 kJ mol^{-1}; N≡N 945 kJ mol^{-1}.

(a) Identify the strongest bond and explain your choice.

[2 marks]

(b) Use the data to compare the strengths of a C–C bond and a C=C bond.

[2 marks]

QUESTION 14 | EXAM STYLE

Magnesium has a giant metallic lattice.

(a) Describe the particles and attraction in metallic magnesium.

[2 marks]

(b) Explain why magnesium conducts electricity as both a solid and a liquid.

[2 marks]

(c) Explain why magnesium has a relatively high melting point.

[2 marks]

QUESTION 15 | EXAM STYLE

Diamond and graphite are giant covalent forms of carbon.

(a) Explain why diamond has a very high melting point.

[2 marks]

(b) Explain why diamond does not conduct electricity.

[2 marks]

(c) Explain why graphite conducts electricity.

[2 marks]

(d) Explain why the layers in graphite can slide over one another.

[2 marks]

QUESTION 16 | EXAM STYLE

Iodine is a simple molecular substance made from I_2 molecules.

(a) Describe the particles and attractions in solid iodine.

[2 marks]

(b) Explain why iodine has a much lower melting point than diamond.

[2 marks]

(c) State what is overcome when iodine melts and what remains intact.

[1 mark]

(d) Explain why iodine does not conduct electricity in the solid or liquid state.

[1 mark]

QUESTION 17 | EXAM STYLE

The properties of four substances are shown.

Substance	Melting point / °C	Conducts solid	Conducts liquid
A	801	no	yes
B	650	yes	yes
C	3550	no	no
D	114	no	no

(a) Identify the most likely structure type for A, B, C and D.

[4 marks]

(b) For each substance, use one conductivity clue to justify the identification.

[4 marks]

QUESTION 18 | EXAM STYLE

Each statement contains a chemistry error. Identify the error and write a corrected statement.

(a) The ionic bond is the transfer of electrons from a metal atom to a non-metal atom.

[2 marks]

(b) Molten sodium chloride conducts because its electrons become free to move.

[2 marks]

(c) Iodine melts because the covalent bond inside each I_2 molecule is broken.

[2 marks]

(d) All ionic compounds dissolve in water simply because their ions are charged.

[2 marks]

SECTION C

HARDER MIXED

Five less-scaffolded applications in unfamiliar contexts

Independent thinking: Choose the structure-to-property route yourself and keep bond formation separate from the attraction that defines the bond.

QUESTION 19 | HARDER MIXED

A student compares sodium chloride, magnesium and iodine.

(a) State the structure type of each substance.

[3 marks]

(b) Predict whether each conducts electricity as a solid and justify each prediction using the available mobile or fixed particles.

[3 marks]

(c) Explain why sodium chloride has a much higher melting point than iodine.

[2 marks]

QUESTION 20 | HARDER MIXED

Element X forms X^{3+} ions. Element Y forms Y^{2-} ions.

(a) Deduce the formula of the compound formed.

[2 marks]

(b) State the total number of electrons transferred when one formula unit forms.

[2 marks]

(c) Draw a complete electron-origin diagram for one formula unit. Show the smallest ion ratio, complete outer shells, brackets and charges.

DIAGRAM SPACE

[6 marks]

QUESTION 21 | HARDER MIXED

Four unfamiliar substances have the following properties.

Substance	Melting point / °C	Solid conductivity	Liquid conductivity
P	80	none	none
Q	1414	none	none
R	770	none	good
S	1085	good	good

(a) Identify the most likely structure type for P, Q, R and S.

[4 marks]

(b) Explain the change in conductivity when R melts.

[3 marks]

(c) Explain why Q has a much higher melting point than P.

[2 marks]

QUESTION 22 | HARDER MIXED

Graphite is used as an electrode. Diamond is used on cutting tools.

(a) Explain why graphite is suitable for use as an electrode.

[3 marks]

(b) Explain why diamond is suitable for use on a cutting tool.

[3 marks]

(c) Explain why graphite is softer than diamond.

[2 marks]

QUESTION 23 | HARDER MIXED

A student writes calcium nitrate as $CaNO_3$ and ammonium sulfate as NH_4SO_4.

(a) Correct both formulae and explain the charge balance in each compound.

[4 marks]

The same student draws the diagram below for $NH_3 + H^+ \rightarrow NH_4^+$.

Student's dative-bond diagram

(b) Identify two errors in the diagram.

[2 marks]

(c) Draw a corrected model diagram.

DIAGRAM SPACE

[2 marks]

SECTION D

STRETCH / SYNOPTIC

One final challenge connecting electron configurations with Bonding I

QUESTION 24 | STRETCH / SYNOPTIC

Stretch note: This question connects Atomic Structure II electron configurations with ionic formulae, electron origin and conductivity.

Atom X has electron configuration $1s^2\ 2s^2\ 2p^6\ 3s^2$. Atom Y has electron configuration $1s^2\ 2s^2\ 2p^5$.

(a) Identify X and Y.

[2 marks]

(b) State the ions formed by X and Y.

[2 marks]

(c) Deduce the formula of the compound formed.

[1 mark]

(d) Draw a complete electron-origin diagram for the compound.

DIAGRAM SPACE

[5 marks]

(e) Explain why the compound does not conduct as a solid but does conduct when molten.

[2 marks]

✓ **DONE:** Mark the pack using the worked answers. For every lost mark, identify whether the error came from the definition, electron origin, charge balance or structure-property chain.

CrackingCHEM

GCSE | A-LEVEL

UNDERSTAND • APPLY • SUCCEED

OCR A H432

Bonding I

Fully worked answers | OCR A-style marking guidance

FULLY WORKED. PRECISELY MARKED. BUILT FOR IMPROVEMENT.

OCR A SPECIFICATION	2.1.2(a) | 2.2.2(a-f,n-o) | linked 3.1.1(d-f)

TEST IT	EXAM STYLE	HARDER MIXED	STRETCH
8	10	5	1

24 QUESTIONS MARKED | **166 MARKS EXPLAINED**

FINAL NOTES-ALIGNED EDITION | FORMULAE • BONDING • STRUCTURE • PROPERTIES

Independent practice material. Every question is original and stays within the finished OCR A Bonding I notes.

OCR A MAP

How this pack matches the finished notes

Full coverage of Bonding I with Bonding II and later Periodicity held back

Specification area	Recurring OCR A demand	Frequent trap	Questions
Ionic formulae	Recall charges; balance charge; use brackets and smallest ratios.	Leaving an unsimplified ratio or omitting brackets around repeated compound ions.	1-2, 10, 20, 23-24
Ionic bonding	Separate electron transfer from electrostatic attraction; prove electron origin.	Calling transfer the bond or omitting brackets, charges or electron totals.	3-4, 9-10, 18-20, 24
Covalent and dative	Use nuclei/shared-pair wording; draw single, multiple and donated pairs.	Incomplete definitions, missing lone pairs or arrows pointing from acceptor to donor.	5-7, 11-13, 23
Metallic and giant covalent	Name particles, attraction, delocalised electrons and structure-property chains.	Using free electrons, ions in graphite, or structure labels without reasoning.	8, 14-15, 17, 19, 21-22
Simple molecular	Distinguish intermolecular forces from covalent bonds during state changes.	Claiming molecules contain ionic bonds or covalent bonds break on melting.	16-19, 21

Research basis: Checked against the final CrackingChem OCR A Bonding I notes, the CrackingChem Year 12 master specification map and OCR A Chemistry H432 specification Version 3.1. Every question is original.

Assessment boundary: No shapes, bond angles, electronegativity, polarity or detailed intermolecular-force types are assessed. Silicon and graphene are not used beyond the limited foundation statement in the notes.

HOW TO SELF-MARK EACH ANSWER

Step	Action
1 Compare	Read the complete model answer before counting marks.
2 Tick	Award one tick only for each distinct marking point shown in brackets.
3 Diagnose	Label the first lost link: definition, charge, electron origin, attraction, energy or mobility.
4 Improve	Rewrite the full answer or redraw the complete diagram without looking.

Diagram marking checklist: Count every outer-shell electron; distinguish its origin; place ionic products in square brackets; write every charge; and make each dative arrow start at the donated pair and point to the acceptor.

SECTION A

TEST IT answers

Direct retrieval with exact OCR A terminology and fully correct diagrams

TEST IT 1

- NO_3^- nitrate [1]; CO_3^{2-} carbonate [1]; SO_4^{2-} sulfate [1]; OH^- hydroxide [1]; NH_4^+ ammonium [1]; Zn^{2+} zinc [1]; Ag^+ silver [1].

Examiner guidance: A correct ion requires both the formula and the charge. A charge written as a subscript is not acceptable.

TEST IT 2

- Aluminium oxide Al_2O_3 [1]; calcium nitrate $Ca(NO_3)_2$ [1]; ammonium sulfate $(NH_4)_2SO_4$ [1].
- Magnesium hydroxide $Mg(OH)_2$ [1]; zinc carbonate $ZnCO_3$ [1]; silver nitrate $AgNO_3$ [1].
- Use brackets only when more than one of a compound ion is needed, so the subscript applies to the whole ion [1].

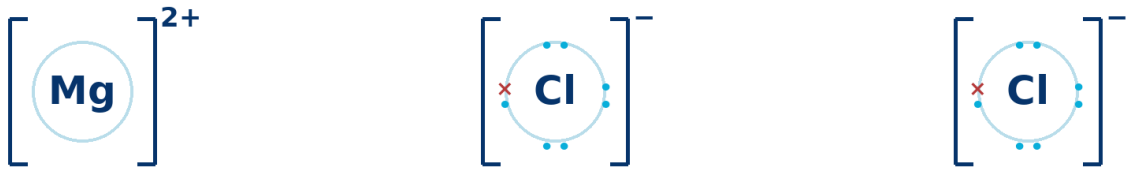
TEST IT 3

- (a) Ionic bonding is the electrostatic attraction [1] between positive and negative ions [1]. [2]
- (b) Electron transfer is the process that forms the ions [1]; the bond is the attraction between the ions after transfer [1]. [2]

TEST IT 4

- One Mg^{2+} ion and two Cl^- ions, all bracketed and correctly charged [2].
- Each chloride ion has eight outer-shell electrons [1], with one electron on each chloride shown as transferred from Mg [1]. Magnesium has lost two electrons in total [1]. [5]

$MgCl_2$: electron-origin ionic diagram



• = anion's original electron × = transferred electron from the metal

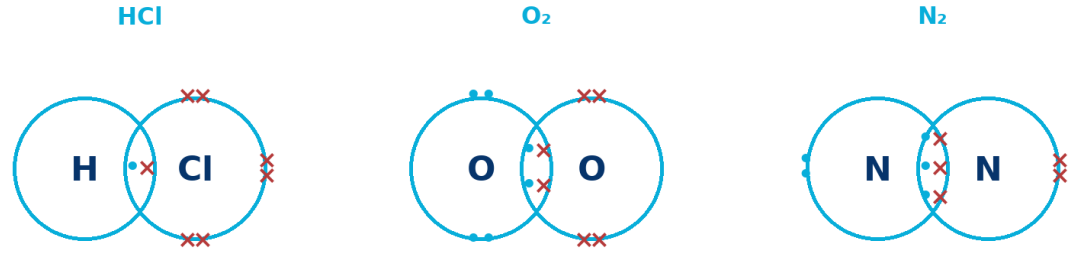
TEST IT 5

- (a) A covalent bond is the strong electrostatic attraction [1] between a shared pair of electrons [1] and the nuclei of the bonded atoms [1]. [3]
- (b) H_2 has one shared pair; O_2 has two; N_2 has three [2]. [2]

TEST IT 6

- HCl: one shared dot-and-cross pair and three lone pairs on Cl [2]. O_2: two shared pairs and two lone pairs on each O [2]. N_2: three shared pairs and one lone pair on each N [3]. [7]

Model electron-origin diagrams

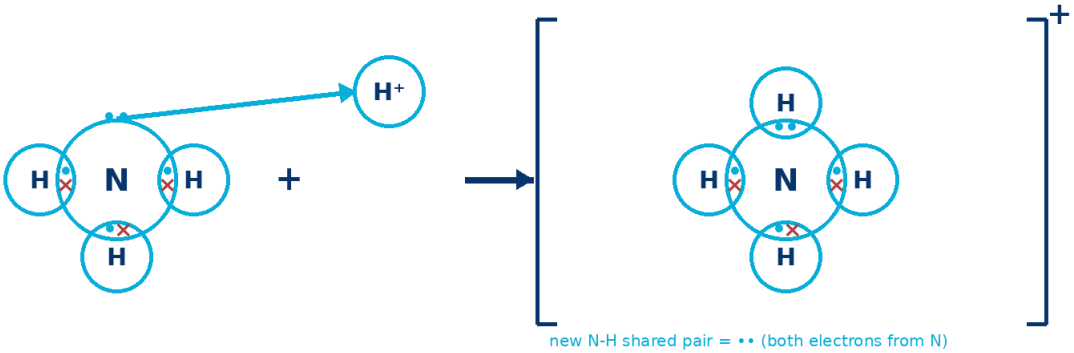


• = electron from the left atom × = electron from the right atom Lone pairs sit on the shell line.

TEST IT 7

- (a) A dative covalent bond is a shared pair of electrons [1] in which both electrons were supplied by the same atom [1]. [2]
- (b) NH_3 is the electron-pair donor and H^+ is the acceptor [1]; the arrow begins at the N lone pair and points towards H^+ [1]. [2]
- (c) NH_4^+ is enclosed in square brackets with an overall + charge [1]; the new N-H shared pair contains two electrons originating from N [1]. [2]

Dative-bond formation: NH_3 donates a lone pair to H^+



new N-H shared pair = •• (both electrons from N)

• = electron from N × = electron from H Arrow starts at the donated pair and points to H^+.

TEST IT 8

- (a) Metallic bonding is the strong electrostatic attraction [1] between positive metal ions and delocalised electrons [1]. [2]
- (b) Bond Y is stronger because it has the larger average bond enthalpy, so more energy is needed to break it [1]. [1]

SECTION B

EXAM STYLE answers

Complete routes, precise particles and model electron-origin diagrams

EXAM STYLE 9

- (a) NaCl has many strong electrostatic attractions between oppositely charged ions throughout a giant lattice [1]; much energy is required to overcome them [1]. [2]
- (b) In solid NaCl, ions are fixed in position, so there are no mobile charge carriers [1]. When molten, the ions are mobile [1] and carry charge through the liquid [1]. [3]
- (c) In aqueous NaCl, dissolved Na^+ and Cl^- ions are mobile and carry charge [1]. [1]
- (d) Ionic compounds are often, but not always, soluble in water; solubility depends on whether new water-ion attractions compensate for separating the ions in the lattice [1]. [1]

EXAM STYLE 10

- (a) Two Na^+ ions are needed for one O^{2-} ion, so the formula is Na_2O [1]. [1]
- (b) Two bracketed Na^+ ions and one bracketed O^{2-} ion [2]; oxide has eight outer-shell electrons [1], including two electrons shown as transferred from sodium [2]; electron totals and charges are consistent with Na_2O [1]. [6]

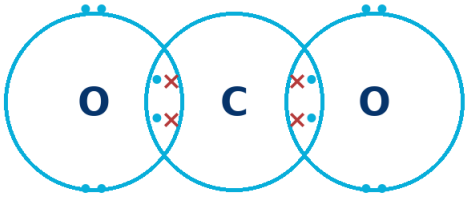
Na_2O: electron-origin ionic diagram

• = anion's original electron × = transferred electron from the metal

EXAM STYLE 11

- (a) Two C=O double bonds contain four shared electron pairs in total [1]. [1]
- (b) Carbon is central with two shared pairs to each oxygen [2]; electron origin is shown consistently in all four shared pairs [2]; each oxygen has two lone pairs and carbon has no lone pairs [2]. [6]

Carbon dioxide: two C=O double bonds

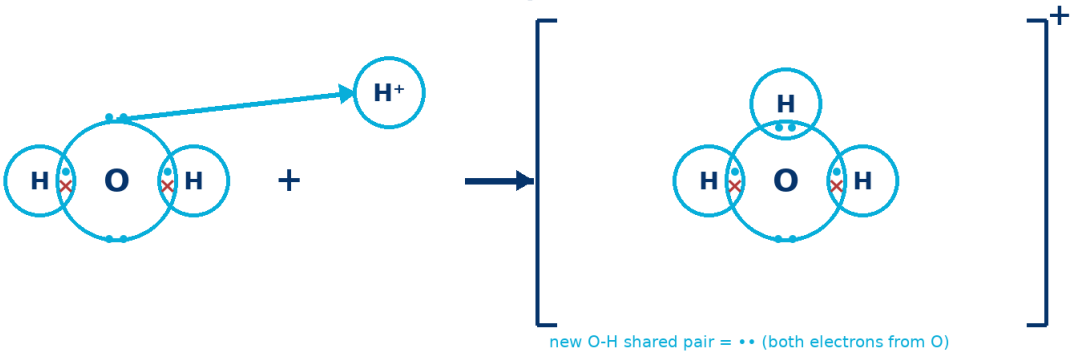


• = oxygen electron × = carbon electron Shared pairs are in the overlaps; lone pairs sit on the shell line.

EXAM STYLE 12

- (a) H_2O is the donor [1]; H^+ is the acceptor [1]; the arrow starts at an oxygen lone pair and points to H^+ [1]. [3]
- (b) H_3O^+ is bracketed and has an overall + charge [1]; the newly formed O-H shared pair contains two electrons from O [1]; the remaining outer electrons are complete and consistently shown [1]. [3]

Dative-bond formation: H_2O donates a lone pair to H^+



new O-H shared pair = •• (both electrons from O)

• = electron from O × = electron from H Arrow starts at the donated pair and points to H^+.

EXAM STYLE 13

- (a) N≡N is strongest because 945 kJ mol^{-1} is the largest average bond enthalpy [1], so it requires the most energy to break [1]. [2]
- (b) C=C is stronger than C-C [1] because 612 kJ mol^{-1} is greater than 347 kJ mol^{-1} [1]. [2]

EXAM STYLE 14

- (a) Magnesium contains positive metal ions and delocalised electrons [1] with strong electrostatic attraction between them [1]. [2]
- (b) Delocalised electrons are mobile in both solid and liquid magnesium [1] and carry electrical charge [1]. [2]
- (c) Strong electrostatic attractions act throughout the giant lattice [1], so much energy is needed to overcome them [1]. [2]

EXAM STYLE 15

- (a) Diamond is a giant three-dimensional covalent network [1]; many strong covalent bonds must be broken, requiring much energy [1]. [2]
- (b) All four outer electrons of each carbon are localised in covalent bonds [1], so there are no mobile charged particles [1]. [2]
- (c) Each carbon in graphite forms three covalent bonds, leaving delocalised electrons [1] that move along the layers and carry charge [1]. [2]
- (d) Only weak attractions act between graphite layers [1], so little energy is needed for layers to slide [1]. [2]

EXAM STYLE 16

- (a) Solid iodine contains neutral I_2 molecules [1] attracted to one another by intermolecular forces [1]. [2]
- (b) Iodine requires only the intermolecular forces between molecules to be overcome [1], whereas diamond requires many strong covalent bonds to be broken [1]. [2]
- (c) Intermolecular forces are overcome; the I-I covalent bonds remain intact [1]. [1]
- (d) Neutral molecules provide no mobile ions or delocalised electrons [1]. [1]

EXAM STYLE 17

- (a) A ionic [1]; B metallic [1]; C giant covalent [1]; D simple molecular [1]. [4]
- (b) A conducts only when its ions become mobile in the liquid [1]. B conducts in both states because delocalised electrons remain mobile [1]. C has no mobile charged particles [1]. D contains neutral molecules and no mobile charge carriers [1]. [4]

EXAM STYLE 18

- (a) Transfer forms the ions [1]; ionic bonding is the electrostatic attraction between oppositely charged ions [1]. [2]
- (b) The charge carriers are mobile Na^+ and Cl^- ions [1], not free electrons [1]. [2]
- (c) Melting iodine overcomes intermolecular forces between I_2 molecules [1]; the I-I covalent bonds remain intact [1]. [2]
- (d) Ionic compounds are often but not always water-soluble [1]; solubility depends on the balance between attractions broken and new solvent-ion attractions formed [1]. [2]

SECTION C

HARDER MIXED answers

Less-scaffolded comparisons, unfamiliar data and corrected misconceptions

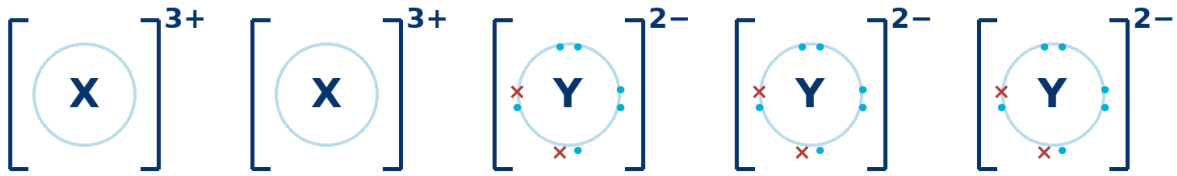
HARDER MIXED 19

- (a) Sodium chloride: giant ionic [1]; magnesium: giant metallic [1]; iodine: simple molecular [1]. [3]
- (b) Solid NaCl does not conduct because its ions are fixed [1]. Solid Mg conducts because delocalised electrons are mobile [1]. Solid iodine does not conduct because neutral I_2 molecules provide no mobile charge carriers [1]. [3]
- (c) NaCl has strong electrostatic attractions throughout a giant lattice [1], whereas melting iodine overcomes weaker intermolecular forces between molecules [1]. [2]

HARDER MIXED 20

- (a) Charge balance requires 2 × (+3) and 3 × (−2), so the formula is X_2Y_3 [2]. [2]
- (b) Two X atoms each lose three electrons, so six electrons are transferred in total [2]. [2]
- (c) Two bracketed X^{3+} ions and three bracketed Y^{2-} ions [2]; each Y^{2-} has eight outer-shell electrons [1], with two transferred electrons shown on each [2]; all charges and the 2:3 ratio are correct [1]. [6]

X_2Y_3: electron-origin ionic diagram



• = anion's original electron × = transferred electron from the metal

HARDER MIXED 21

- (a) P simple molecular [1]; Q giant covalent [1]; R ionic [1]; S metallic [1]. [4]
- (b) In solid R, ions are fixed and cannot carry charge [1]. On melting, ions become mobile [1] and carry charge through the liquid [1]. [3]
- (c) Q requires many strong covalent bonds in a giant network to be broken [1], whereas P requires only intermolecular forces between molecules to be overcome [1]. [2]

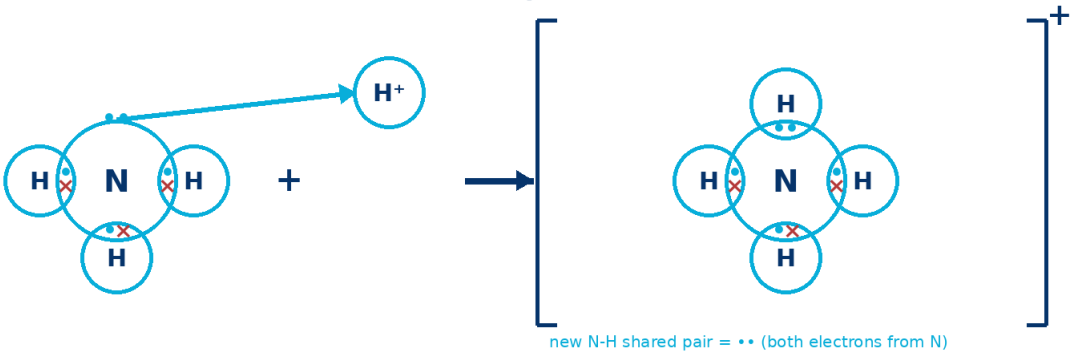
HARDER MIXED 22

- (a) Graphite contains delocalised electrons [1] that are mobile along the layers [1] and carry electrical charge through the electrode [1]. [3]
- (b) Diamond is a rigid three-dimensional network [1] in which each carbon forms four strong covalent bonds [1], making it very hard and resistant to deformation [1]. [3]
- (c) Graphite layers are held together by weak attractions [1], allowing the layers to slide over one another [1]. [2]

HARDER MIXED 23

- (a) Calcium nitrate is $Ca(NO_3)_2$: one Ca^{2+} requires two NO_3^- ions [2]. Ammonium sulfate is $(NH_4)_2SO_4$: two NH_4^+ ions balance one SO_4^{2-} ion [2]. [4]
- (b) The arrow is reversed; it must begin at the nitrogen lone pair and point to H^+ [1]. The product must be enclosed in square brackets with an overall + charge [1]. [2]
- (c) Correct model: NH_3 donates its lone pair to H^+ and forms bracketed NH_4^+ [2]. [2]

Dative-bond formation: NH_3 donates a lone pair to H^+



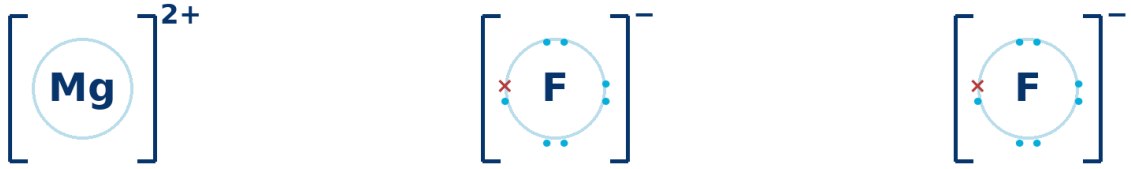
new N-H shared pair = •• (both electrons from N)

• = electron from N × = electron from H Arrow starts at the donated pair and points to H^+.

STRETCH / SYNOPTIC 24

- (a) X has 12 electrons, so X is magnesium, Mg [1]. Y has 9 electrons, so Y is fluorine, F [1]. [2]
- (b) Mg loses two electrons to form Mg^{2+} [1]; F gains one electron to form F^- [1]. [2]
- (c) One Mg^{2+} requires two F^- ions, so the formula is MgF_2 [1]. [1]
- (d) One bracketed Mg^{2+} and two bracketed F^- ions [2]; each fluoride has eight outer-shell electrons [1], including one electron shown as transferred from Mg [1]; final electron totals and charges are correct [1]. [5]

MgF_2: electron-origin ionic diagram



• = anion's original electron × = transferred electron from the metal

- (e) In solid MgF_2, ions are fixed and cannot carry charge [1]. When molten, the ions are mobile and carry charge [1]. [2]

Final check: Every complete property explanation names the structure, particles and attraction before discussing energy or mobility. Correct the earliest wrong link before reworking the rest.