Structure and Bonding Fundamental ANSWERS

1 Complete the table to show the formula and structure type (use ✓s) of the following substances. (10)

Substance	Formula	Monatomic	Simple molecular	Giant covalent	Ionic	Metallic
silver(I) nitrate	$AgNO_3$				✓	
bromine	Br_2		✓			
potassium bromide	KBr				✓	
calcium	Ca					✓
aluminium sulfate	$Al_2(SO_4)_3$				✓	
argon	Ar	✓				
ammonia	NH_3		✓			
ammonium chloride	NH_4Cl				✓	
hydrogen sulfide	H_2S		✓			
graphene	C			✓		

1 Complete the table to show the formula and structure type (use ✓s) of the following substances. (8)

Substance	Formula	Monatomic	Simple molecular	Giant covalent	Ionic	Metallic
ammonia	NH_3		✓			
iodine	I_2		✓			
lithium bromide	LiBr				✓	
potassium	K					✓
aluminium hydroxide	$Al(OH)_3$				✓	
diamond	C			✓		
buckminsterfullerene	C_{60}		✓			
helium	He	✓				

1 Complete the table using ✓s to show which type of structure the following substances have. (8)

Substance	Monatomic	Simple molecular	Giant covalent	Ionic	Metallic
helium (He)	✓				
nitrogen fluoride (NF_3)		✓			
silicon chloride ($SiCl_4$)		✓			
strontium chloride ($SrCl_2$)				✓	
iron oxide (Fe_2O_3)				✓	
phosphorus (P_4)		✓			
silicon dioxide (SiO_2)			✓		
iridium (Ir)					✓

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Give the formula of each of the following ionic substances. (8)

a) potassium bromide ✓ **KBr**

b) aluminium sulfide ✓ **Al_2S_3**

c) magnesium hydroxide ✓ **$Mg(OH)_2$**

d) iron(III) nitrate ✓ **$Fe(NO_3)_3$**

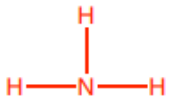
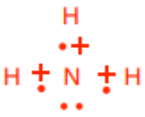
e) cobalt(II) carbonate ✓ **$CoCO_3$**

f) ammonium nitrate ✓ **NH_4NO_3**

g) titanium(IV) oxide ✓ **TiO_2**

h) rubidium sulfate ✓ **Rb_2SO_4**

Draw stick diagrams and dot-cross diagrams for each of these molecules. (8)

	NH_3	CO_2	HBr	N_2
stick diagram				
dot-cross diagram				

11 Write a balanced equation for each of these reactions. ✓ **correct formulas** & ✓ **balanced** (6)

a) calcium + water

✓✓ **$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$**

b) ethanethiol (C_2H_5SH) + oxygen

✓✓ **$C_2H_5SH + 4.5O_2 \rightarrow 2CO_2 + 3H_2O + SO_2$**

c) zinc + hydrochloric acid

✓✓ **$Zn + 2HCl \rightarrow ZnCl_2 + H_2$**

d) potassium carbonate + nitric acid

✓✓ **$K_2CO_3 + 2HNO_3 \rightarrow 2KNO_3 + CO_2 + H_2O$**

e) ammonia + sulfuric acid

✓✓ **$2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$**

f) copper(II) oxide + nitric acid

✓✓ **$CuO + 2HNO_3 \rightarrow Cu(NO_3)_2 + H_2O$**

Structure and Bonding Fundamental ANSWERS

3 Write a balanced equation for each of these reactions. ✓ correct formulas & ✓ balanced (8)

a) copper(II) carbonate + nitric acid

✓✓ $CuCO_3 + 2HNO_3 \rightarrow Cu(NO_3)_2 + CO_2 + H_2O$

b) magnesium oxide + hydrochloric acid

✓✓ $MgO + 2HCl \rightarrow MgCl_2 + H_2O$

c) silane (SiH_4) + oxygen

✓✓ $SiH_4 + 2O_2 \rightarrow SiO_2 + 2H_2O$

d) calcium + hydrochloric acid

✓✓ $Ca + 2HCl \rightarrow CaCl_2 + H_2$

3 Write a balanced equation for each of these reactions. ✓ correct formulas & ✓ balanced (10)

a) potassium oxide + hydrochloric acid

✓✓ $K_2O + 2HCl \rightarrow 2KCl_2 + H_2O$

b) barium + water

✓✓ $Ba + 2H_2O \rightarrow Ba(OH)_2 + H_2$

c) propane (C_3H_8) + oxygen

✓✓ $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

d) magnesium + nitric acid

✓✓ $Mg + 2HNO_3 \rightarrow Mg(NO_3)_2 + H_2$

e) zinc(II) carbonate + sulfuric acid

✓✓ $CuCO_3 + H_2SO_4 \rightarrow CuSO_4 + CO_2 + H_2O$

8 Describe what each of the following formulae tells you about the substance shown.

a) Ammonia has the molecular formula NH_3

✓ in each molecule
✓ 1 N atom and 3 H atoms (2)

b) Silicon dioxide has the formula SiO_2

✓ ratio through structure
✓ is 1 Si atom : 2 O atoms (2)

c) Aluminium oxide has the formula Al_2O_3.

✓ ratio through structure
✓ is 2 Al^{3+} : 3 O^{2-} ions (2)

d) Sulfur has the molecular formula S_8.

✓ in each molecule
✓ 8 S atoms (2)

Structure and Bonding Fundamental ANSWERS

12 Explain each of the following.

a) Magnesium chloride has a high melting point.

- ✓ **ionic structure**
- ✓ **strong attraction between positive and negative ions**
- ✓ **takes a lot of energy to overcome attraction** (3)

b) Copper conducts electricity.

- ✓ **outer shell**
- ✓ **electrons are delocalised**
- ✓ **and carry charge through structure / metal** (3)

c) Methane has a low boiling point.

- ✓ **simple molecular**
- ✓ **weak forces between molecules**
- ✓ **does not need much energy to overcome attraction** (3)

d) Aluminium oxide conducts electricity when molten but not as a solid.

- ✓ **ions cannot move as solid**
- ✓ **ions can move as liquid**
- ✓ **and carry charge through structure** (3)

e) Helium has a very low boiling point.

- ✓ **monatomic**
- ✓ **weak forces between atoms**
- ✓ **does not need much energy to overcome attraction** (3)

9 The element carbon exists in several different forms (allotropes), including diamond, graphite and graphene.

a) Explain why these forms of carbon all have high melting points.

- ✓ **giant covalent structure**
- ✓ **need to break covalent bonds**
- ✓ **takes a lot of energy to overcome** (3)

b) Explain why graphite and graphene are electrical conductors but diamond is not.

- ✓ **graphite has delocalised electrons**
- ✓ **and carry charge through structure**
- ✓ **diamond has no delocalised electrons** (3)

c) Buckminsterfullerene is another form of carbon with the formula C_{60}. Explain how the formula C_{60} tells us that this is a molecular substance and not a giant covalent substance.

- ✓ **there are 60 C atoms in each molecule**
- ✓ **if it was giant covalebt the formula would be C as it is an empirical formula** (2)