

Lewis Structures

Key ideas

Steps: (1) Add up valence electrons (subtract for + charge, add for – charge). (2) Put the least electronegative atom in the centre (never H). (3) Connect atoms with single bonds. (4) Complete octets on outer atoms, then the central atom. (5) If the central atom lacks an octet, turn lone pairs into double or triple bonds.

Octet rule: 8 electrons around each atom, except H (2). Each line = 2 shared electrons; each pair of dots = a lone pair.

A Valence electrons of elements

3 marks

Element	1. C	2. N	3. O	4. Cl	5. Mg	6. Ne
Valence electrons						

B Total valence electrons

3 marks

½ mark each. Remember to adjust for the charge on ions.

Species	7. H ₂ O	8. CO ₂	9. NH ₄ ⁺	10. SO ₄ ²⁻	11. CH ₃ OH	12. NO ₃ ⁻
Total valence e ⁻						

C Draw the Lewis structure

8 marks

Show all bonds and lone pairs. Use brackets and the charge for the ion. 1 mark each.

13. H ₂ O	14. NH ₃	15. CH ₄	16. CO ₂
17. HCN	18. N ₂	19. CH ₂ O	20. NH ₄ ⁺

D Bonding pairs and lone pairs

2 marks

Use your structures from Part C. ½ mark per row.

	Molecule	Bonding pairs on central atom	Lone pairs on central atom
21.	H ₂ O (central O)		
22.	NH ₃ (central N)		
23.	CO ₂ (central C)		
24.	N ₂ (central N)		

E Lewis diagrams for ionic compounds

2 marks

Show the electrons transferred, the ions in brackets and their charges.

25. Sodium chloride, NaCl

26. Magnesium oxide, MgO

F Spot the mistake

2 marks

27. A student draws CO₂ as O–C–O with single bonds and three lone pairs on each oxygen. Explain the error and correct it.

28. A student draws a double bond between carbon and hydrogen. Explain the error and correct it.

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ANSWER KEY

Key ideas

Steps: (1) Add up valence electrons (subtract for + charge, add for – charge). (2) Put the least electronegative atom in the centre (never H). (3) Connect atoms with single bonds. (4) Complete octets on outer atoms, then the central atom. (5) If the central atom lacks an octet, turn lone pairs into double or triple bonds.

Octet rule: 8 electrons around each atom, except H (2). Each line = 2 shared electrons; each pair of dots = a lone pair.

A Valence electrons of elements

3 marks

Element	1. C	2. N	3. O	4. Cl	5. Mg	6. Ne
Valence electrons	4	5	6	7	2	8

B Total valence electrons

3 marks

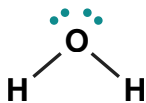
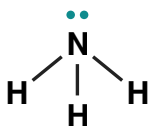
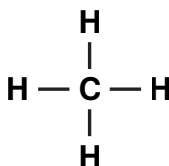
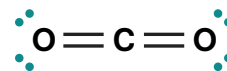
½ mark each. Remember to adjust for the charge on ions.

Species	7. H ₂ O	8. CO ₂	9. NH ₄ ⁺	10. SO ₄ ²⁻	11. CH ₃ OH	12. NO ₃ ⁻
Total valence e ⁻	8	16	8	32	14	24

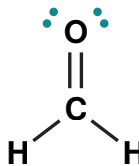
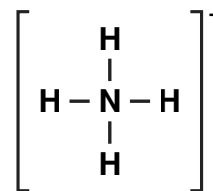
C Draw the Lewis structure

8 marks

Show all bonds and lone pairs. Use brackets and the charge for the ion. 1 mark each.

13. H₂O14. NH₃15. CH₄16. CO₂

17. HCN

18. N₂19. CH₂O20. NH₄⁺

D Bonding pairs and lone pairs

2 marks

Use your structures from Part C. ½ mark per row.

	Molecule	Bonding pairs on central atom	Lone pairs on central atom
21.	H ₂ O (central O)	2	2
22.	NH ₃ (central N)	3	1
23.	CO ₂ (central C)	4	0
24.	N ₂ (central N)	3	1

E Lewis diagrams for ionic compounds

2 marks

Show the electrons transferred, the ions in brackets and their charges.

25. Sodium chloride, NaCl



26. Magnesium oxide, MgO



F Spot the mistake

2 marks

27. A student draws CO₂ as O–C–O with single bonds and three lone pairs on each oxygen. Explain the error and correct it.

That uses 16 electrons, but carbon would only have 4. Moving a lone pair from each O into a bond gives O=C=O, so every atom has an octet.

28. A student draws a double bond between carbon and hydrogen. Explain the error and correct it.

Hydrogen can only hold 2 electrons, so it always forms exactly one single bond.