

Ionic or Covalent? Bonding Worksheet

Electronegativity values (Pauling)

H 2.1						
Li 1.0	Be 1.5	B 2.0	C 2.5	N 3.0	O 3.5	F 4.0
Na 0.9	Mg 1.2	Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0
K 0.8	Ca 1.0					Br 2.8
						I 2.5

metal non-metal / metalloid

How to classify a bond

1. Find ΔEN = larger EN – smaller EN.

2. Use the scale:

0 – 0.4
nonpolar
covalent0.5 – 1.7
polar covalent1.8 and up
ionicThe more electronegative atom gets the partial negative charge (δ^-).A Calculate ΔEN and classify each bond

10 marks

	Bond	ΔEN	Bond type
1.	Na–Cl		
2.	H–Cl		
3.	C–H		
4.	O–H		
5.	K–F		
6.	C–O		
7.	Cl–Cl		
8.	Mg–O		
9.	N–H		
10.	S–H		

B Rank by bond polarity

2 marks

11. Least → most polar: **C–H, O–H, N–H**

12. Least → most polar: **C–F, C–Cl, C–O**

C Partial charges

4 marks

Label which atom is δ^- and which is δ^+ .

13. H–Cl

14. O–H

15. C–F

16. N–H

D Compare ionic and covalent compounds

6 marks

	Property	Ionic compounds	Covalent compounds
17.	How the bond forms		
18.	Elements usually involved		
19.	State at room temperature		
20.	Melting point		
21.	Conducts electricity when molten or dissolved		
22.	Example		

E Ionic or covalent compound?

6 marks

Hint: metal + non-metal is usually ionic; two non-metals are covalent.

23. NaCl _____
24. CO₂ _____
25. MgO _____
26. H₂O _____
27. CaF₂ _____
28. NH₃ _____

F Lab detective

2 marks

29. A white solid melts at 801 °C, dissolves in water, and the solution conducts electricity. Ionic or covalent?

30. A clear liquid boils at 80 °C and does not conduct electricity. Ionic or covalent?

G Challenge

2 marks

31. The H–F bond has $\Delta\text{EN} = 1.9$, above the 1.7 cut-off, yet HF is a covalent molecule. Explain.

32. Which has more ionic character, LiF or NaCl? Show your ΔEN values.

Ionic or Covalent? Bonding Worksheet

Name: _____

Date: _____ Score: ____ / 32

ANSWER KEY

Electronegativity values (Pauling)

H 2.1							
Li 1.0	Be 1.5	B 2.0	C 2.5	N 3.0	O 3.5	F 4.0	
Na 0.9	Mg 1.2	Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0	
K 0.8	Ca 1.0					Br 2.8	
						I 2.5	

metal | non-metal / metalloid

How to classify a bond

- Find ΔEN = larger EN – smaller EN.
- Use the scale:

0 – 0.4
nonpolar
covalent

0.5 – 1.7
polar covalent

1.8 and up
ionic

The more electronegative atom gets the partial negative charge (δ^-).

A Calculate ΔEN and classify each bond

10 marks

	Bond	ΔEN	Bond type
1.	Na–Cl	2.1	Ionic
2.	H–Cl	0.9	Polar covalent
3.	C–H	0.4	Nonpolar covalent
4.	O–H	1.4	Polar covalent
5.	K–F	3.2	Ionic
6.	C–O	1.0	Polar covalent
7.	Cl–Cl	0.0	Nonpolar covalent
8.	Mg–O	2.3	Ionic
9.	N–H	0.9	Polar covalent
10.	S–H	0.4	Nonpolar covalent

B Rank by bond polarity

2 marks

11. Least → most polar: **C–H, O–H, N–H****C–H (0.4) < N–H (0.9) < O–H (1.4)**12. Least → most polar: **C–F, C–Cl, C–O****C–Cl (0.5) < C–O (1.0) < C–F (1.5)**

C Partial charges

4 marks

Label which atom is δ^- and which is δ^+ .13. **H–Cl** **Cl is δ^- , H is δ^+** 14. **O–H** **O is δ^- , H is δ^+** 15. **C–F** **F is δ^- , C is δ^+** 16. **N–H** **N is δ^- , H is δ^+**

D Compare ionic and covalent compounds

6 marks

	Property	Ionic compounds	Covalent compounds
17.	How the bond forms	Electrons transferred (ions form)	Electrons shared
18.	Elements usually involved	Metal + non-metal	Non-metal + non-metal
19.	State at room temperature	Crystalline solid	Gas, liquid or soft solid
20.	Melting point	High	Low
21.	Conducts electricity when molten or dissolved	Yes	No (usually)
22.	Example	NaCl, MgO	H ₂ O, CO ₂

E Ionic or covalent compound?

6 marks

Hint: metal + non-metal is usually ionic; two non-metals are covalent.

23. NaCl Ionic
24. CO₂ Covalent
25. MgO Ionic
26. H₂O Covalent
27. CaF₂ Ionic
28. NH₃ Covalent

F Lab detective

2 marks

29. A white solid melts at 801 °C, dissolves in water, and the solution conducts electricity. Ionic or covalent?
Ionic: high melting point and conducts when dissolved.
30. A clear liquid boils at 80 °C and does not conduct electricity. Ionic or covalent?
Covalent: low boiling point and no free ions to carry charge.

G Challenge

2 marks

31. The H-F bond has $\Delta EN = 1.9$, above the 1.7 cut-off, yet HF is a covalent molecule. Explain.
Both are non-metals and share electrons; the ΔEN cut-offs are guidelines on a continuum, so H-F is best described as a very polar covalent bond.
32. Which has more ionic character, LiF or NaCl? Show your ΔEN values.
LiF: $\Delta EN = 4.0 - 1.0 = 3.0$, greater than NaCl's $3.0 - 0.9 = 2.1$.