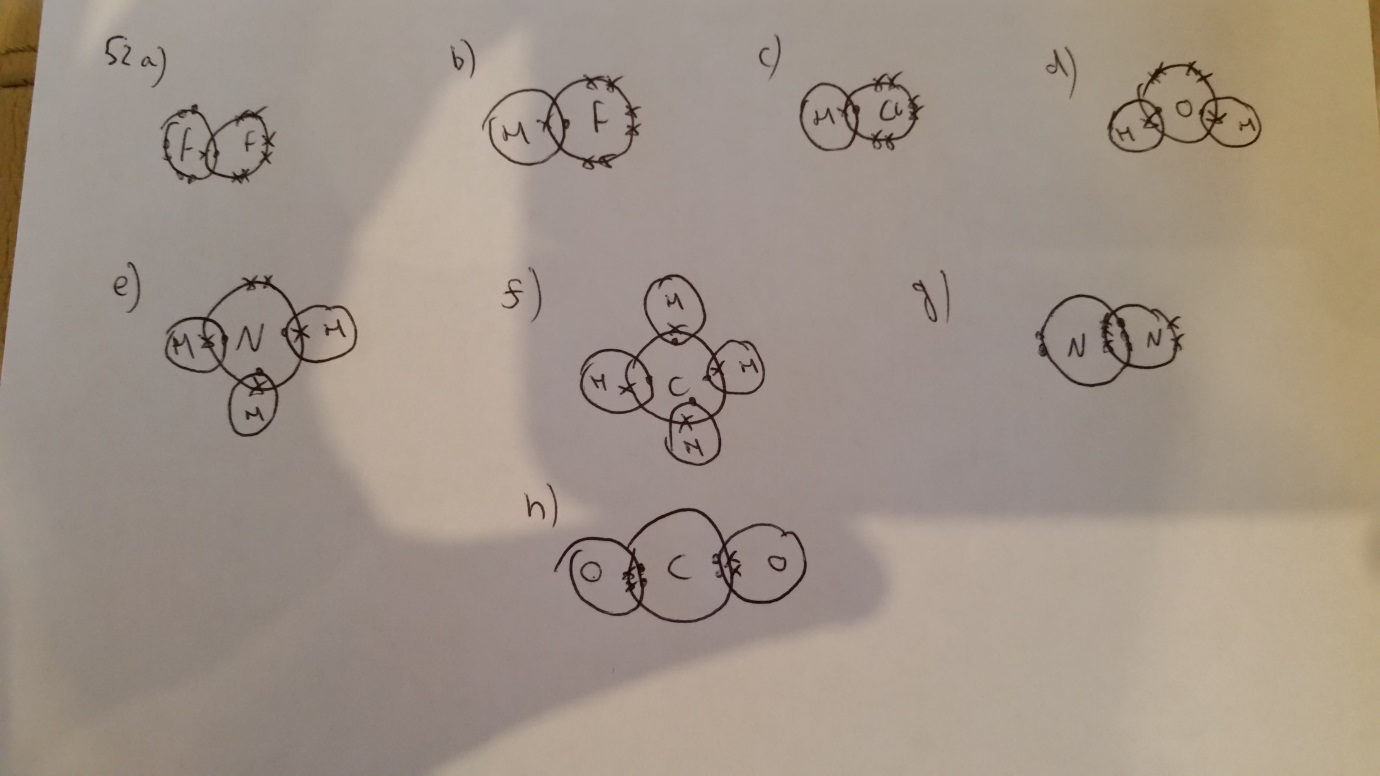
Bonding booklet answers

1. +1, 0, -1
2. Atom, protons, electrons, charge
3. 2 on first shell, 7 on second
4. 9
5. 0
6. The number of protons and electrons are equal so the charges balance out
7. 9
8. Atoms have equal numbers of protons and electrons
9. It no longer has equal numbers of protons as electrons
10. +1
11. +2
12. -1
13. -5
14. As they have a negative charge
15. 14
16. 15
17. 9
18. 54
19. Elements are made of one type of atom, compounds more than one type chemically bonded
20. Plum pudding is sphere or positive charge with negative charges (electrons) studded in, nuclear has positive charge concentrated in nucleus and electrons orbiting
21. 2Li(s) + Cl2(g) 🡪 2LiCl(s)
22. Solid, gas, solid
23. Molecular is billions of molecules with no chemical bonds between them. Giant is billions of atoms with chemical bonds between them
24. Atoms: equal numbers of protons and electrons  
    Isotopes: different atoms with equal numbers of protons, different numbers of neutrons  
    Ions: unequal numbers of protons and electrons

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element name and symbol** | **Group** | **Number of electrons in outer shell** | **Will it lose or gain electrons? How many?** | **Charge on ion** |
| Lithium, Li | 1 | 1 | Will lose one | Li+ |
| Beryllium, Be | 2 | 2 | Lose two | Be2+ |
| Oxygen, O | 6 | 6 | Gain two | O2- |
| Nitrogen, N | 5 | 5 | Gain three | N3- |
| Boron, B | 3 | 3 | Lose three | B3+ |
| Fluorine, F | 7 | 7 | Gain one | F- |
| Phosphorous, P | 5 | 5 | Gain three | P3- |
| Rubidium | 1 | 1 | Lose one | Rb+ |

* 1. 2; 1+ charge
  2. 2, 8, 8 1- charge
  3. 2; 2+ charge
  4. 2,8,8; 2- charge
  5. 2,8; 3+ charge
  6. 2,8; 3- charge
  7. 2,8; 2+ charge
  8. 2,8,8; 1+ charge

1. Chlorine
2. Calcium
   1. Lithium gives one to fluorine
   2. Two potassium atoms each give one to oxygen
   3. Three chlorine atoms each give one to aluminium
   4. Two sodium atoms give one to an oxygen
   5. Aluminium gives three to a nitrogen
   6. Two aluminiums between them give six electrons to three oxygens (which each take two)
3. –
4. They both need to gain electrons
5. They both need to lose electrons
6. Because they are both positive
7. One electron from sodium is transferred to chlorine forming a positive sodium ion and a negative chlorine ion that can be attracted electrostatically
8. Aluminium transfers one electron to three different chlorine atoms forming a 3+ aluminium ion and three 1- chlorine ions that can be attracted electrostatically
9. Giant ionic lattice made of alternating Al3+ and Cl- ions held together by the electrostatic force of attraction
   1. One electron from magnesium to two different chlorine atoms forming the ions referenced in the question which are attracted to each other electrostatically and can form a giant ionic lattice
   2. Two potassium atoms each transfer one electron to a sulphur atom forming a giant ionic lattice of alternating K+ and S2- ions held together by the electrostatic force of attraction
10. –
11. (s) is a solid where the ions are held in a giant ionic lattice. (aq) is dissolved in water where the ions from the lattice have separated and are free to move
12. Giant ionic lattice made of strong electrostatic force between alternating ions of positive and negative charge which requires a large amount of energy to break
13. One electron from sodium transferred to chlorine
14. 19
15. 8
16. 8 protons, 10 electrons
17. Two potassium atoms each transfer one electron to an oxygen, forms 2K+ and O2-
18. K2O
19. They have opposite charges
20. Giant ionic lattice
21. High melting and boiling point, does not conduct electricity as solid, does conduct as (aq) or (l)
22. Giant ionic lattice; Its ions are not free to move and it does not have delocalised electrons
23. Giant ionic lattice; strong ionic bonds formed from electrostatic force of attraction between oppositely charged ions, requires lots of energy to break
24. 
25. Li with 2 electrons on outer shell and 1+ charge, fluorine with 2,8 and 1- charge
26. Metal and non-metal, metal loses electron, non-metal gains
27. High melting and boiling point, only conducts electricity when (l) or (aq)
28. No
29. Fluorine, chlorine, carbon, oxygen, any non-metal
30. 18.94
    1. Hydrogen + fluorine 🡪 hydrogen fluoride
    2. H2 + F2 🡪 2HF
31. –
32. Hard, high melting and boiling point, not conduct electricity
33. High melting point
34. Strong covalent bonds between the atoms require lots of energy to break
35. Ionic
36. Aluminium loses electrons, iodine gains
37. Aqueous or molten
38. 4
39. 14
40. 0, -1
41. The Rutherford scattering experiment
    1. They would both be high
    2. Melt them/dissolve and see which conducts electricity
    3. One is made of ions, the other of atoms
42. Made of carbon atoms, giant covalent structures
43. Graphite is in layers, is soft and conducts electricity
44. Delocalised electrons are free to move through the graphite
45. Element is only one type of atoms chemically bonded, compound is two or more
    1. See which conducts electricity when solid
    2. Ionic substance conducts by the movement of ions, graphite by the movement of electrons
    3. Sodium is a metal and chlorine is a non-metal
    4. Sodium is 2,8 with a 1+ charge, chlorine is 2,8,8 with a 1- charge
    5. Giant ionic lattice; strong ionic bonds formed from electrostatic force of attraction between oppositely charged ions, requires lots of energy to break
46. As in 52
47. They have a covalent bond between them which is strong
48. Low melting and boiling point, not to conduct electricity
    1. See previous definitions on Quizlet
    2. N, O2 CO2 H2O Ar
    3. –
    4. Nitrogen, oxygen or argon
    5. Water or carbon dioxide
    6. Argon
    7. All of them
49. It is a larger molecule so the intermolecular force is stronger
50. Weak intermolecular forces between molecules do not reauire a lot of energy to break
51. It has no free ions or delocalised electrons
52. Giant covalent has billions of atoms chemically bonded not just a few into molecules
53. They have no free ions or delocalised electrons
    1. As the chain increases in length, the melting and boiling point increases
    2. The larger the molecule, the stronger the intermolecular force, the more energy required to break, the greater the melting and boiling point
54. –
    1. –
       1. Covalent
       2. Carbon
       3. 3
    2. It is soft as the layers can slide over each other and off the material onto the paper
55. It has delocalised electrons that are free to move through the graphite and carry charge
56. –
    1. –
       1. Covalent
       2. Covalent
    2. It is very small
    3. It has delocalised electrons that are free to move through the nanotube
57. -

|  |  |  |
| --- | --- | --- |
| Sodium | Sodium | Metallic |
| Carbon | Silicon | Covalent |
| Carbon | Carbon | Covalent |
| Oxygen | Lithium | Ionic |
| Silver | Fluorine | Ionic |
| Magnesium | Chlorine | ionic |
| Magnesium | Calcium | Metallic |
| Beryllium | Nitrogen | Ionic |
| Phosphorous | Oxygen | Covalent |

1. ^
2. Layers of positive metal ions with a sea of delocalised electrons held together by electrostatic interaction between positive ions and negative electrons
3. the electrostatic force between the delocalised electrons and metal ions is strong
4. It is malleable and conducts electricity
5. Delocalised electrons are free to move through the graphite
6. They do not have free ions or delocalised electrons to carry charge
7. (l) or (aq)
8. Easy to bend into shape
9. They both need to lose electrons
10. Magnesium, more electrons in the sea of delocalised and greater positive charge on the ion means greater strength of electrostatic attraction and more energy required to break
11. Layers of positive metal ions with a sea of delocalised electrons held together by electrostatic interaction between positive ions and negative electrons. Delocalised electrons can move through the metal and carry charge
12. It has different sized atoms which disturb the layers
13. They would be too soft/would corrode too easily
14. –
    1. Delocalised electrons free to move through the metal
    2. Malleable as layers can slide over each other
    3. Strong force of electrostatic attraction between metal ions and delocalised electrons
15. –
    1. Metal
    2. Simple molecular
    3. Giant covalent
    4. Giant ionic lattice
    5. Simple molecular
16. –
    * 1. C
      2. A
      3. D
      4. B
17. More electrons in aluminium to be donated to the sea of delocalised electrons and can carry more charge/current

Bonding summary questions

1. Metal or graphite
2. Both conduct electricity and have high melting points
3. One will be harder than the other
4. Try to dissolve in water or melt and see if it conducts electricity
5. Simple molecular (only metal possibility is Hg)
6. No, has no delocalised electrons
7. –
8. –
9. Because they have layers which can slide over each other
10. Giant ionic
11. Only have weak intermolecular forces between the molecules so they are easy to separate
12. Metal is only one type of atom, alloy has others mixed in
13. They have atoms of different sizes which disturb the layers and prevent them from travelling
14. Giant covalent substance, high melting point
15. Graphite has delocalised electrons, diamond does not
16. None
17. Delocalised electrons
18. The bonds do not need to be broken to turn methane into a gas; only the forces between the molecules need to be broken and they are weak
19. Similarities: contain sodium, sodium contained as ions in both, both arranged in neat rows and layers, both conduct electricity when molten. Differences: ionic has negative charge, often soluble, metals conduct when solid, metals soft, ionic brittle, metals have delocalised electrons, ionic does not
20. Graphite conducts as it has delocalised electrons. Sodium chloride conducts as it has *ions* that are free to move.
21. Because it only has the names of the elements on it
22. Group: electrons in outer shell, period: number of shells
23. 2,1
24. 1+
25. Compound
26. Discovery of electrons – specifically those in the outer shell relevant for reactivity
27. Ionic
28. Potassium transfers one electron to chlorine
29. High melting and boiling point, malleable, conductor of thermal energy and electricity
30. Low melting and boiling point, does not conduct electricity
31. Yes, same group

potassium + oxygen 🡪 potassium oxide

4K(s) + O2(g) 🡪 2K2O(s)

potassium + chlorine 🡪 potassium chloride

2K(s) + Cl2(g) 🡪 2KCl(s)

potassium + water 🡪 potassium hydroxide + hydrogen

2K(s) + 2H2O(l) 🡪 2KOH(aq) + H2(g)

1. Solid, liquid, gas, aqueous
2. Because gas has been formed which escapes
   1. Metallic, covalent, ionic
   2. Simple molecular substance, weak intermolecular force, easy to break
   3. (l) or (aq)
   4. Delocalised electrons free to flow through the metal
3. Easier to lose outer electron due to more shells, more shielding, greater nucleus-electron distance
4. Harder to lose outer electrons due to fewer shells, less shielding, shorter nucleus-electron difference
5. They react with oxygen from the air
6. It is too reactive
7. Depends on how easy it is to lose the electron
8. lithium + water 🡪 lithium hydroxide + hydrogen  
   2Li(s) + 2H2O(l) 🡪 2LiOH(aq) + H2(g)
9. As above
10. As in 123
11. Strength of attraction from positive potassium nucleuses to delocalised electrons is weaker
12. 7
13. Covalent
14. As above
15. Same as 134
16. Simple molecular substance, weak intermolecular force requires little energy to break
17. Bigger atoms, more electrons, stronger intermolecular attraction
18. Easier to gain an electron due to fewer shells, less shielding, shorter nucleus- electron distance
19. Harder to gain an electron due to more shells, more shielding, greater nucleus- electron distance
20. Easier to lose outer electron due to more shells, more shielding, greater nucleus-electron distance
21. 2Li + Cl2 🡪 2LiCl
22. Br2 +2 LiI 🡪 2LiBr + I2
23. Iodine and bromine are elements, lithium iodide and bromide are compounds
24. Ionic
25. Giant ionic lattice, strong electrostatic force of attraction between oppositely charged ions, requires lots of energy to break. Fluorine is simple molecular with weak intermolecular force which does not require a lot of energy to break
26. Harder to gain an electron due to more shells, more shielding, greater nucleus- electron distance
27. Simple molecular substance, no free ions or delocalised electrons
28. –
    1. B
    2. D
    3. E
    4. C
    5. 6.08
29. For group 1 increases down the group as Easier to lose outer electron due to more shells, more shielding, greater nucleus-electron distance. Group 7 decreases down the group as Harder to gain an electron due to more shells, more shielding, greater nucleus- electron distance
30. Very reactive, small distance from nucleus to outer shell, very little shielding
31. Argon is unreactive as it has a full outer shell and does not need to gain or lose electrons