Chemistry – Atomic Structure and the periodic table

1. What is the name given to the smallest part of an element that can exist?
   Atom
2. About how many elements are there in the periodic table?
   100
3. What name is given to two or more elements chemically combined in fixed proportions?
   Compound
4. What name is given to two or more elements or compounds not chemically combined?
   Mixture
5. What are filtration, crystallisation, simple distillation, fractional distillation and chromatography all used for?
   Separation of mixtures
6. What name is given to an incorrect model of an atom that suggested atoms are a ball of positive charge with negative electrons embedded in them?
   Plum pudding model
7. Who adapted the nuclear model of the atom by suggesting that electrons orbit the nucleus at specific distances?
   Niels Bohr
8. What was James Chadwick able to provide evidence for the existence of?
   Neutrons in the nucleus
9. Complete the table

Name of particle	Relative Charge
Proton	***+1***
Neutron	***0***
Electron	***-1***

10. What does the atomic number indicate about the atoms of an element?
    The number of protons
11. What is the approximate radius of an atom?
    0.1nm ($1x10^{-10}$m)
12. Complete the table

Name of particle	Relative mass
Proton	***1***
Neutron	***1***
Electron	***Very small***

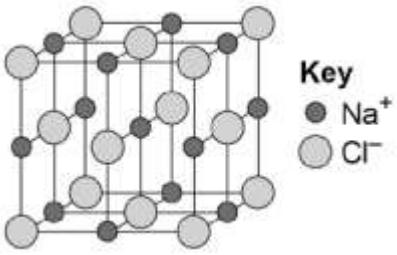
13. What is the mass number of an element the sum of?
    The protons and neutrons in an atom
14. What is the name of atoms of the same element that have different numbers of neutrons?
    Isotopes
15. What are elements in the periodic table arranged in order of?

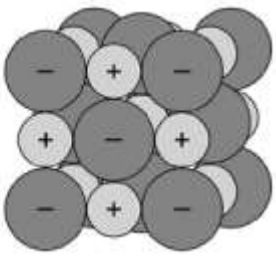
Atomic number

16. What do elements in the same group of the periodic table have in common?
    The same number of electrons in the outer shell and similar properties
17. How did Mendeleev overcome problems with ordering the elements?
    He left gaps for undiscovered elements
18. What react to form positive ions?
    Metals
19. The elements of which group of the periodic table are unreactive and do not easily form molecules?
    Group 0
20. Which group of the periodic table is known as the alkali metals?
    Group 1
21. Does reactivity increase or decrease going down group 1?
    Increase
22. Which group of the periodic table is known as the halogens?
    Group 7

Chemistry – Bonding, structure and the properties of matter

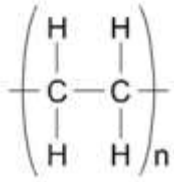
23. What are the three types of chemical bond?
    Ionic metallic and covalent
24. Which chemical bond forms when non-metals combined with metals?
    Ionic
25. What charge do ions of group 2 elements have?
    +2
26. What charge do ions of group 7 elements have?
    -1
27. Which ionic structure can be represented in the following forms:





Sodium Chloride

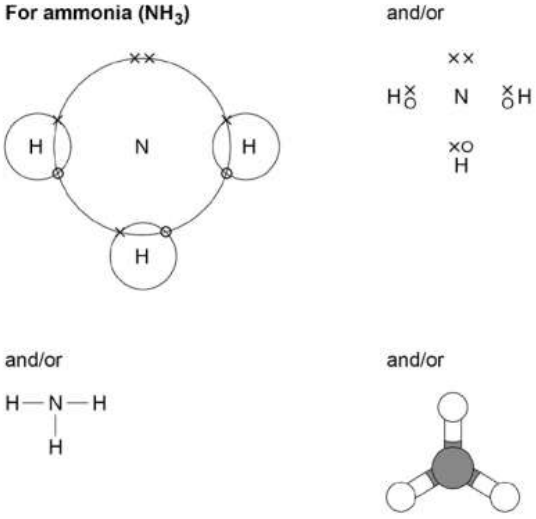
28. What is a covalent bond?
29. ***A shared pair of electrons between two atoms***
30. What type of structure is represented here:



Polymer

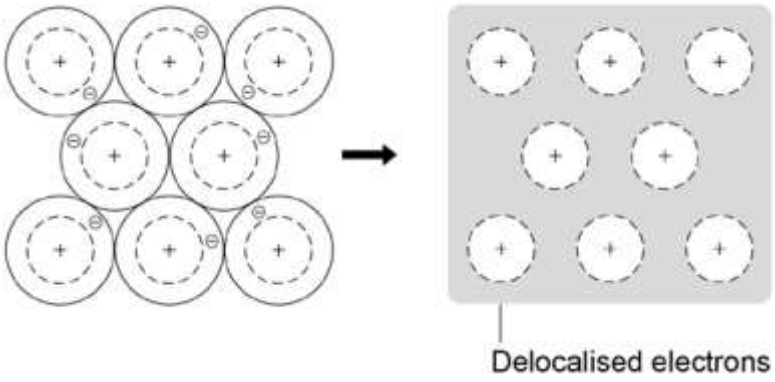
31. What does (aq) show in a chemical equation?
    Aqueous solution
32. What state of matter are most polymers at room temperature?
    Solid

33. What type of chemical bonding is represented in these diagrams?



Covalent

34. Which type of chemical bonding can be represented in the following form:



Metallic

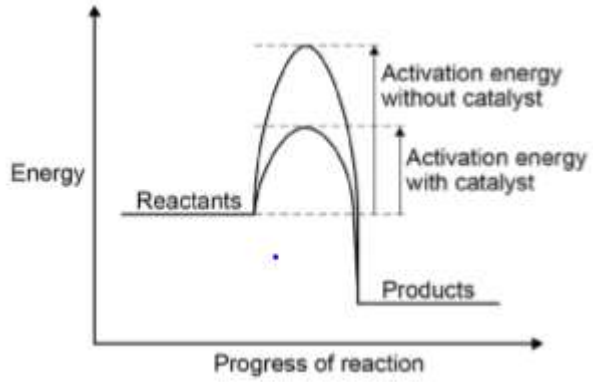
35. What determines the amount of energy needed to melt or boil a substance?
The strength of the forces/bonds between the particles
36. State key properties of ionic compounds.
They have high melting and boiling points and they conduct electricity when molten or dissolved in water
37. What forces acting between small molecules hold them together when liquid?
Weak intermolecular forces
38. Name three examples of giant covalent structures that you need to know.
Diamond, graphite and silica
39. How are atoms arranged in pure metals?
Layers
40. Which particles in metals allow them to conduct electricity and thermal energy?
Delocalised electrons
41. How many covalent bonds does each carbon atom in diamond have?
4
42. How many covalent bonds does each carbon atom in graphite have?
3
43. Which material is a single layer of graphite and has properties that make it useful in electronics and composites?

Graphene

44. What name is given to cylindrical fullerenes with very high length to diameter ratios?
    Carbon nanotubes

Topic – Rates of Reaction

45. What name is given to a reaction that transfers energy to the surroundings, increasing the temperature of the surroundings?
    Exothermic
46. What name is given to a reaction that transfers energy from the surroundings, decreasing the temperature of the surroundings?
    Endothermic
47. What name is given to the minimum amount of energy that particles must have to react in a chemical reaction?
    Activation energy
48. How is the rate of a chemical reaction calculated?
    Mean rate of reaction = $\frac{\text{quantity of product formed}}{\text{Time taken}}$ **OR**
    Mean rate of reaction = $\frac{\text{quantity of reactant used}}{\text{Time taken}}$
49. What two units can be used for rate of reaction?
    The units of rate of reaction may be given as g/s or cm3/s. (HT: Need to know quantity of reactants in terms of moles and units for rate of reaction in mol/s.)
50. What is the collision theory?
    Chemical reactions can occur only when reacting particles collide with each other and with sufficient energy. The minimum amount of energy that particles must have to react is called the activation energy.
51. Name 5 factors that cause a reaction to speed up?
    Temperature, Concentration, Surface Area, Catalyst, Pressure
52. How does increasing temperature increase the rate of a chemical reaction?
    The particles gain more energy, move faster increasing the number of successful collisions.
53. How does increasing the concentration affect the frequency of collisions?
    More particles in a set volume means the particles are more likely to collide with sufficient energy.
54. What is a catalyst?
    Catalysts change the rate of chemical reactions but are not used up during the reaction. Different reactions need different catalysts. Enzymes act as catalysts in biological systems.
55. How does a Catalyst speed up a chemical reaction?
    Provides an alternative pathway for a reaction by lowering the activation energy.
56. A reaction profile shows the energy changes in a reaction. Sketch an energy profile diagram from an exothermic reaction including the pathway taken when a catalyst is used.



57. What does the symbol, [redacted], mean in an equation?
    Reversible Reaction
58. If the reverse reaction is exothermic (gives out heat) what condition would favour the forward reaction?
    Endothermic reaction (takes in heat)
59. What is an equilibrium?
    When a reversible reaction occurs in apparatus that prevents the escape of reactants and products equilibrium is reached when the forward and reverse reactions occur at exactly the same rate.

<u>Chemistry of the Atmosphere</u>

60. What are the main gases in today's atmosphere?
    Nitrogen (approximately 80%) and Oxygen (approximately 20%).
61. How is it thought that the early gases in the atmosphere were produced?
    Volcanic eruptions
62. What gases where thought to be in the early atmosphere?
    Carbon dioxide (mainly), Nitrogen, Ammonia, Methane
63. What two main events led to the changes in the atmosphere during its evolution?
    Earth cooled and water vapour condensed to form oceans.
    Plants evolved so photosynthesis occurred taking in carbon dioxide and releasing oxygen.
64. What effect do the greenhouse gases have on the Earth?
    Greenhouse gases in the atmosphere maintain temperatures on Earth high enough to support life. Water vapour, carbon dioxide and methane are greenhouse gases.
65. How did carbon dioxide decrease in the early atmosphere?
    Plants evolved using carbon dioxide for photosynthesis.
    Carbon dioxide dissolved in oceans getting locked up in sedimentary rocks and fossil fuels.
66. What two greenhouse gases are increasing due to human activity?
    Carbon dioxide & methane
67. Name two human activities that have increased the amount of carbon dioxide in the modern atmosphere.
    Burning fossil fuels, increased cars on roads.
68. Name three effects of global climate change.
    Ice caps melt, sea levels rise, increased extreme weather e.g. hurricanes.
69. What is a carbon footprint?
    The carbon footprint is the total amount of carbon dioxide and other greenhouse gases emitted over the full life cycle of a product, service or event.
70. What environmental problem does sulfur dioxide and oxides of nitrogen cause?

Acid rain

71. What environmental problem is caused by carbon particulates from a sooty flame?
    Global dimming
72. Carbon monoxide is a toxic gas produced by what reaction?
    Incomplete Combustion
73. What do humans use the Earth's resources for?
    Warmth, shelter, food and transport.
74. What type of products are provided by natural resources?
    Food, timber, clothing, fuels.
75. What is a finite resource?
    A resource that is limited because it takes a long time (often millions of years) to form.
76. What is a sustainable development?
    A development that meets the needs of current generations without compromising the ability of future generations to meet their own needs.
77. What is potable water?
    Water that is safe to drink.
78. Name three sterilising agents used to make potable water.
    Chlorine, ozone, ultraviolet light.
79. What are the stages involved in producing potable water?
    choosing an appropriate source of fresh water; passing the water through filter beds; sterilising.
80. If supplies of fresh water are limited, desalination of salty water or sea might be required. Describe how sea water could be desalinated.

    Desalination can take place by distillation (heat the salty water, the water evaporates and then is condensed to collect pure water, all salts and water will be left behind) or reverse osmosis can be used.

81. Sewage treatment includes:
    screening and grit removal; sedimentation to produce sewage sludge and effluent; anaerobic digestion of sewage sludge; aerobic biological treatment of effluent.
82. Phytomining a method used to extract copper from low grade ores. How does this work?
    Phytomining uses plants to absorb metal compounds. The plants are harvested and then burned to produce ash that contains metal compounds.
83. Bioleaching a method used to extract copper from low grade ores. How does this work?
    Bioleaching uses bacteria to produce leachate solutions that contain metal compounds.
84. Life cycle assessments (LCAs) are carried out to assess the environmental impact of products in each of four stages. What are the three stages?
    extracting and processing raw materials; manufacturing and packaging; use and operation during its lifetime; disposal at the end of its useful life, including transport and distribution at each stage.
85. What happens when metals are recycled?
    Metals can be recycled by melting and recasting or reforming into different products.