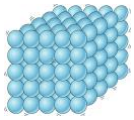
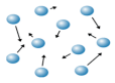
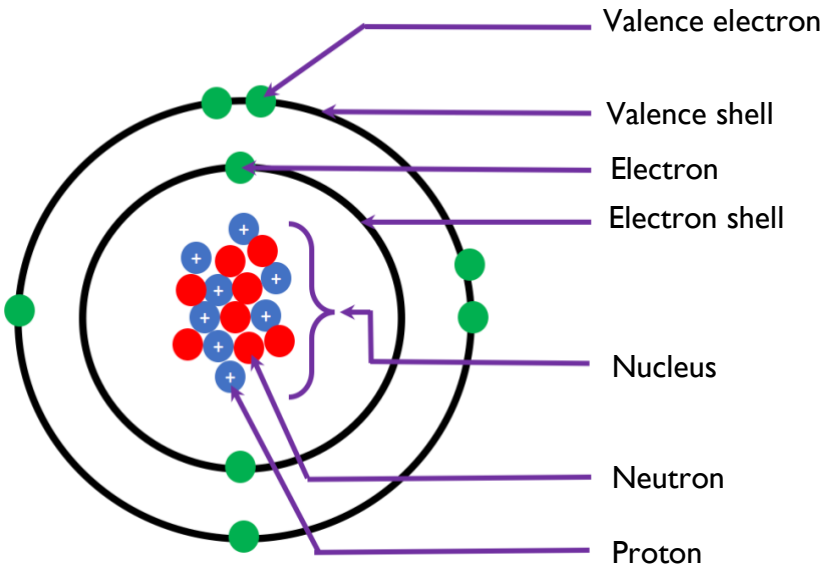
ANSWERS TO SECONDARY 2 SCIENCE PRACTICE MIDTERM

1. Energy, strength of bonds, and particle models of the 3 phases of matter:

	Amount of Energy	Strength of Bond	Particle Model
Solid	Little energy	Strong bond (particles only vibrate)	
Liquid	More energy	Weaker bond (particles can move around more)	
Gas	Lots of energy	Very weak bonds (particles move freely)	

2. This is a diagram of an atom. You need to know each part, and recognize what the number of protons and electrons signify.



3. Use the **Periodic Table** to recognize whether these substances are atoms or molecules. Remember:

- An **atom** is one singular element from the table.
- A **molecule** is two or more atoms joined together.

Substance	Atom or molecule?	Number of different elements	Total number of atoms
Br_2	Molecule	1 (Bromine)	2
Cu	Atom	1 (Copper)	1
H_2O	Molecule	2 (Hydrogen, Oxygen)	3
$C_8H_{10}N_4O_2$	Molecule	4 (Carbon, Hydrogen, Nitrogen, Oxygen)	24
Be_3N_2	Molecule	2 (Beryllium, Nitrogen)	5
He	Atom	1 (Helium)	1
$Ca(OH)_2$	Molecule	3 (Calcium, Oxygen, Hydrogen)	5

4. Use the periodic table to help answer this question (it will be provided on your exam). Remember:

- The atomic number (the small number at the top of each element) represents the number of protons. This is also the number of electrons.
- The number underneath the element symbol is the atomic mass. You may round it to the nearest whole number.
- The number of neutrons can be found using this equation: Atomic mass – Number of protons

Element Name	Symbol	Atomic Number	Number of Protons	Number of Neutrons	Mass Number
Fluorine	F	9	9	19 – 9 = 10	19
Caesium	Cs	55	55	133 – 55 = 78	133
Vanadium	V	23	23	51 – 23 = 28	51
Helium	He	2	2	2	4
Lead	Pb	82	82	207 – 82 = 125	207

5. The coefficient in front (large number) tells you the number of molecules, while the subscript (smaller number) tells you the number of individual atoms of a particular element.

$4\ Al(OH)_3$

4 molecules
4 Al (aluminum) atoms
12 O (oxygen) atoms
12 H (hydrogen) atoms

$1\ Li_2S$

1 molecule
2 Li (lithium) atoms
1 S (sulphur) atom

$5\ C_6H_{12}O_6$

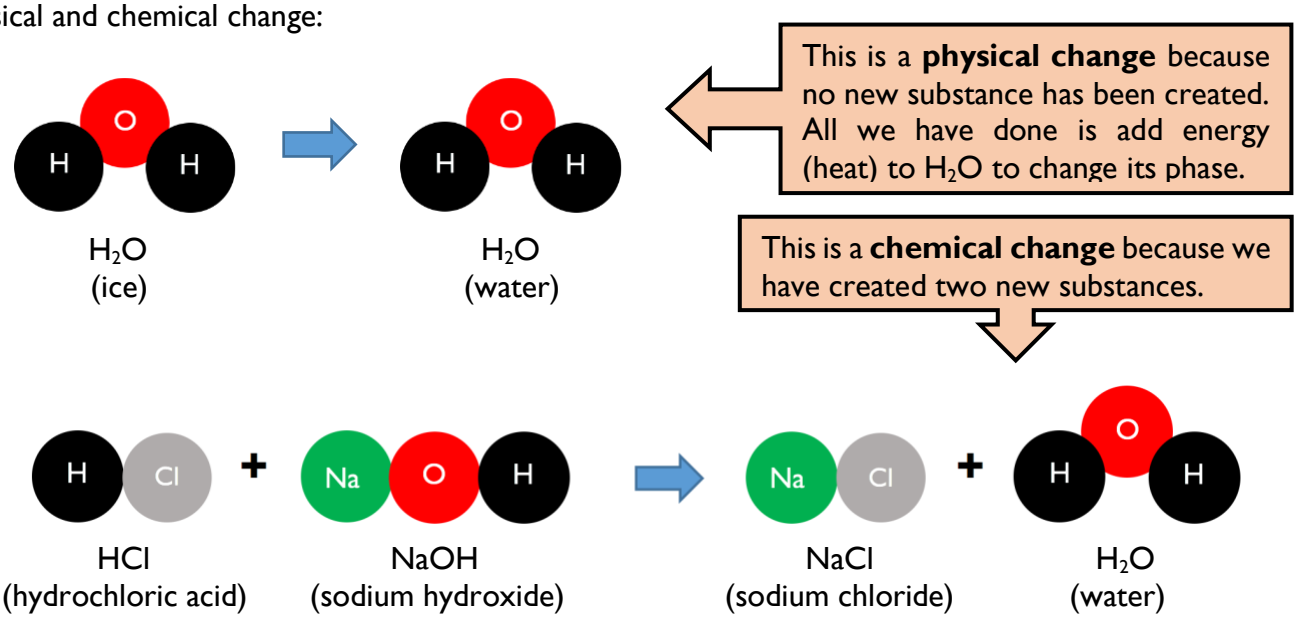
5 molecules
30 C (carbon) atoms
60 H (hydrogen) atoms
30 O (oxygen) atoms

6. The group number (usually written in roman numerals) represents the **number of valence electrons**. Remember that **groups** are **columns** (running up and down) in the periodic table. For example, F, Cl, and Br all have 7 valence electrons because they are in Group VII.

7. The period number represents the **number of electron shells**. Remember that **periods** are **rows** (running from left to right) in the periodic table. For example, Ca, V, and Kr are all in the 4th row of the table, so they have 4 electron shells.

8. Elements in the same group have similar properties because an element's behaviour depends on the number of valence electrons. For example, any atom with 1 or 7 valence electrons is extremely reactive. Any atom with 8 valence electrons is very stable.

9. A **physical** change produces no new substance, meaning that molecules stay the same. A **chemical change** produces a new substance because the molecules are rearranged. These are Dalton-model examples of a physical and chemical change:



10. There are 5 signs of a chemical change:

1. A change in colour
2. Residue forming
3. Release of light
4. Release of gas
5. Change in temperature

11. There are 3 signs of a physical change:

1. A change in phase (ex: water freezing into ice)
2. A change in shape (ex: breaking a pencil in half)
3. Preparing or separating a mixture (ex: picking mushrooms off of a pizza)

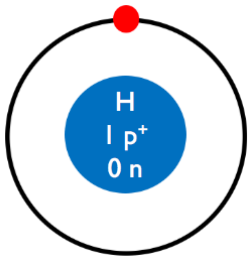
12. Physical or chemical?

a. Cutting an ice cream cake into pieces: Physical (change of shape)
b. Solid iodine turning into a purple gas when heated: Physical (change of phase)
c. Activating a hand warmer package, producing heat: Chemical (change in temperature)
d. Mixing baking soda and vinegar, producing a gas: Chemical (release of gas)
e. Snow melting: Physical (change in phase)
f. Mixing two colourless liquids, producing a yellow precipitate: Chemical (residue forming)

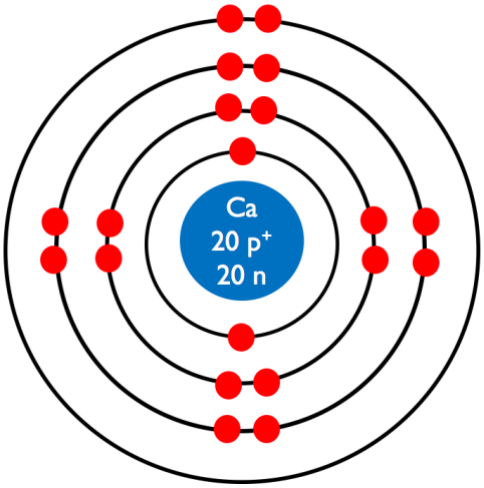
13. Here are the steps for successfully drawing Bohr-Rutherford diagrams.

- Look up your element in the periodic table and note the atomic number. This is the number of protons (and electrons).
- Determine how many neutrons your atom has (Neutrons = Atomic mass – atomic number).
- Draw a circle in the middle. Inside the circle, write the symbol of your element, the number of protons, and the number of neutrons.
- Check what row your element is in. The row (period) represents the number of electron shells. Draw the correct number of electron shells around the nucleus.
- Fill in the electrons. Remember that the first shell can only hold 2 electrons. The remaining ones hold a maximum of 8 electrons. You must fill shells completely before moving onto the next ones.

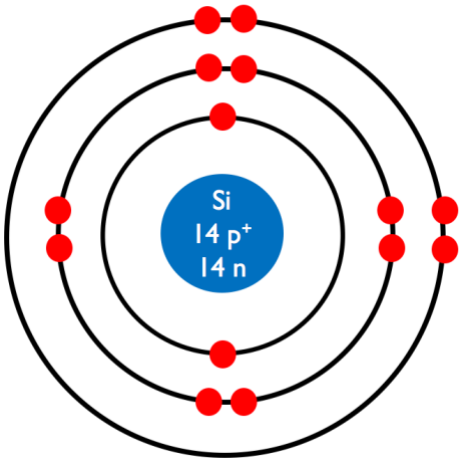
Hydrogen



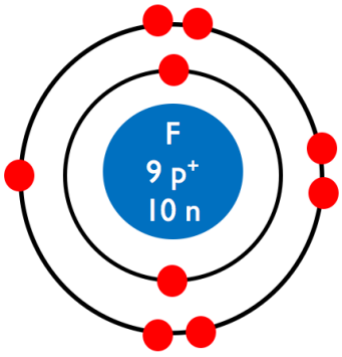
Calcium



Silicon



Fluorine



14. The difference between **mass** and **volume** is that mass represents the amount of matter a substance has. Volume measures the amount of space the substance occupies.

15. Density is a characteristic property that measures the amount of mass a substance has per unit of volume. Its formula is:

$$D = \frac{m}{V}$$

16. Density calculations:

a. Mass of unknown substance = 75.1 g – 40.0 g = 35.1 g *(Be careful not to include the mass of the cylinder!)*
Volume = 25.6 mL

$$D = \frac{m}{V} = \frac{35.1\ g}{25.6\ mL} = 1.37\ \frac{g}{mL}$$

b. Mass of unknown metal = 4525.74 g
Volume = l x w x h = 15.3 cm x 4.25 cm x 8.0 cm = 520.2 cm^3

$$D = \frac{m}{V} = \frac{4525.74\ g}{520.2\ cm^3} = 8.7\ \frac{g}{cm^3}$$

c. Mass of mineral = 52 g
Volume = 52 mL – 35 mL = 17 mL *(Be careful not to include the water that was already in the cylinder!)*

$$D = \frac{m}{V} = \frac{52\ g}{17\ mL} = 3.06\ \frac{g}{mL}$$

d. Mass of necklace = 53.6 g
Volume = 12.5 mL – 10 mL = 2.5 mL

$$D = \frac{m}{V} = \frac{53.6\ g}{2.5\ mL} = 21.44\ \frac{g}{mL}$$ This density is nearly exactly the same, so this is platinum.

17. The difference between a rock and a mineral is that a rock is a mixture (several substances) that contains minerals. A mineral is a pure substance (only one substance).

18. Types of rocks:
- **a.** Rocks that often contain traces of fossils are **sedimentary rocks**.
- **b.** Rocks which have layers of crystals are **igneous rocks**.
- **c.** Rocks which have large, distinct, and varied types of grains that are cemented together are **metamorphic rocks**.

19. **Intrusive igneous rocks** are formed when magma cools and hardens within the earth's crust. **Extrusive igneous rocks** are formed when lava cools and hardens above the Earth's crust.

20. Continuous **heat** and **pressure** must be applied to an igneous or sedimentary rock to transform it into a metamorphic rock.

21. The processes that produce sediments are **erosion** and **weathering**. Once compacted, the sediment can form sedimentary rocks.

22. Mineral testing.

- **a.** The colour that a mineral leaves on a porcelain plate is its **streak colour**.
- **b.** The property of a mineral to attract or be repelled by a magnet is its **magnetism**.
- **c.** The property of a mineral to resist scratching is its **hardness**.
- **d.** The property of a mineral to react with an acid is "**reacts with acid**" (produces H_2 bubbles)
- **e.** The amount of mass per unit of volume is its **density**.

23. Types of motion:

1. Motion that describes a curve or a circle is **circulatory motion** (c).
2. A back and forth motion around a central point is **oscillatory motion** (d).
3. Motion executed in one direction and then another is **alternating motion** (b).
4. Motion that is in a single direction and straight line is **rectilinear motion** (a).

24. For any motion to occur, a **force** must be present.

25. An object in motion will stop when the force is no longer applied and the object is overcome by a stronger force in the opposite direction (i.e. friction).

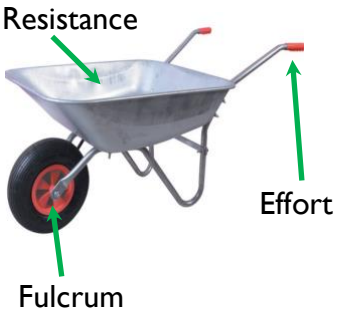
26. Types of forces

- **a.** Taking a tissue from a Kleenex box: Tension (pulling force)
- **b.** Jumping on a trampoline: Deflection (bending force)
- **c.** Wringing out a wet towel: Torsion (twisting force)
- **d.** Tearing a sheet of paper: Shearing (cutting force)
- **e.** Pressing a button on a calculator: Compression (pushing or squeezing force)

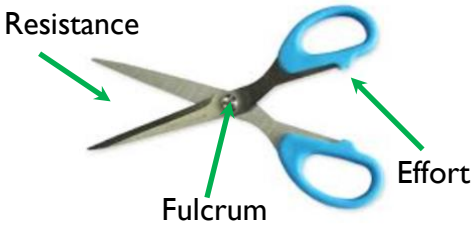
27. Types of simple machines being used:

1. The first picture shows somebody cutting a piece of cake using a knife. The knife is a **wedge** (a type of inclined plane).
2. The second picture shows a lawn mower. Its wheels are **wheels and axles**.
3. The third picture shows a see saw. This is a **1st class lever**. It is 1st class because the fulcrum is in between the effort force (you) and the resistant force (C-3PO)
4. The fourth picture shows a blind being retracted by pulling down on a string. The string is connected with a **pulley**.
5. The fifth picture shows an axe chopping wood. The axe is a **wedge** (a type of inclined plane).
6. The sixth picture shows a wheelchair being pushed up a **ramp** (inclined plane).
7. The seventh picture shows a can of paint being pried open with a screwdriver. The blade of the screwdriver is a **wedge** (a type of inclined plane).
8. The eighth picture shows somebody unscrewing a lightbulb by twisting it. Its screw-like guiding makes it a **screw** (a type of inclined plane, where the ramp circles an axis).

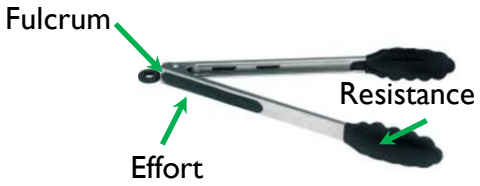
28. In a 1st class lever, the fulcrum is between the effort and resistance forces.
In a 2nd class lever, the resistance force is between the effort force and fulcrum.
In a 3rd class lever, the effort force is between the resistance force and fulcrum.



2nd class lever



1st class lever



3rd class lever

29. Mechanical advantage is a comparison between the amount of force you put in (the effort force) and the resistant force (or load). A simple machine (ex: a pulley system) will reduce the amount of effort you need to put in.

30. The machine with the mechanical advantage of 0.7 would be more efficient because it is a higher number. The higher the mechanical advantage, the less effort force is required.

31. Types of energy.

1.	I listened to my iPod:	Acoustic/sound energy (d)
2.	The colours of the rainbow are beautiful:	Radiant energy (a)
3.	Natural gas is a clean burning fuel:	Chemical (f)
4.	I had to charge my phone:	Electrical (e)
5.	My slinky stretched as it went down the stairs:	Elastic (c)
6.	Splitting an atom generated radioactive waste:	Nuclear (g)
7.	The magnet stuck to the fridge:	Magnetic (h)
8.	I warmed up by the fireplace:	Thermal (b)

32. Fill in the blanks:

1. According to the **law of conservation of energy**, energy cannot be created or destroyed.
2. A change from electrical energy to radiant energy is called an **energy transformation**.
3. A force that resists the sliding of one surface over another is **friction**.
4. A microwave oven changes **electrical** energy to radiant energy to **thermal** energy.
5. Suppose you are shooting a basketball toward a hoop. As the ball rises in the air, its **potential** energy increases and its **kinetic** energy decreases.
6. As the ball falls back toward the floor, its **kinetic** energy increases and its **potential** energy decreases.
7. Friction transforms some mechanical energy into **thermal** energy.
8. You use a lamp to change **electrical** into **radiant** (or thermal) energy.
9. When you use a battery, you transform chemical energy stored in the battery to **electrical** energy.
10. The exhaust from a car contains **thermal** energy that cannot be used. Scientists often refer to this energy as waste energy.