Cells, Organs, and Tissue of Living Things

1. What characteristics do all living things posses?

In order for something to be considered alive it must show certain characteristics. Living things...

- are composed of cells
- require energy (for movement, repair etc...)
- grow
- respond to the environment
- have a limited life span
- produce waste (heat, carbon dioxide, urine etc...)
- produce offspring like themselves
- evolve or change over time

2. Identify the organelles of both a plant and animal cell and describe the function of each.

Organelle	Function
Nucleus	• Control center of the cell • Contains DNA
Nuclear Membrane	• Thin, double-layered membrane that encloses the cell's genetic material • Contains pores
Chromatin (Chromosomes)	• Long strands of DNA
Nucleolus	• A darker area within the nucleus • Manufactures ribosomes
Ribosomes	• Manufactures proteins necessary for cell growth/reproduction
Cell Membrane	• Separates cell contents from surroundings • Selectively permeable
Cytoplasm	• Gel-like material that supports the structures of the cell
Endoplasmic Reticulum	• System of canals which transport materials to different parts of the cell
Mitochondria	• Produces energy for a cell
Golgi Body	• Packages up and moves (secretes) materials out of the cell
Vacuoles	• Fluid-filled • Stores water, food, waste etc...
Lysosomes	• Breaks down food and digests wastes and worn-out cell parts
Cell Wall	• Rigid structure surrounding the cell membrane of plants • Provides support for the cell
Chloroplasts	• In plants cells • Contains chlorophyll and enables plants to make carbohydrates through the process of photosynthesis
Centrioles	• In animal cells • Organize spindle fibres during mitosis

3. What are the main differences between plant and animal cells?

Plant	Animal
Rectangular Cell Wall Chloroplasts	Circular or irregular in shape No cell wall No chloroplasts

4. Identify the parts of a microscope and describe the function of each part.

Structure	***Function***
stage clips	To hold the slide in place
Revolving nosepiece	allows objective lenses to be changed
ocular (eyepiece)	To magnify the object
diaphragm	controls or regulates the amount of light that enters the object being viewed
Coarse adjust	used only at low power, to help focus object
Fine adjust	used with medium and high power for focusing
Objective lens	Magnify the object different amounts – low, medium, high

5. Calculate the high power field of view for a microscope with a low power field of view of 3.8mm if the eyepiece lens = 10x, low power lens = 4x, and high power lens = 40x.

   3.8 mm x (40/400) = 0.38 mm = 380 µm

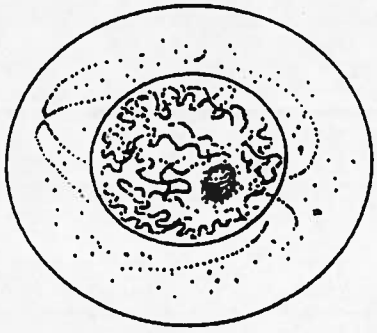
6. Estimate the length and width of the identified plant cell in the diagram. The cells were observed under high power using the same microscope from the previous example.

   Length = FV/#fit = 380 µm/2.5 = 153 µm

   Width = FV/#fit = 380 µm/7.5 = 50.7 µm

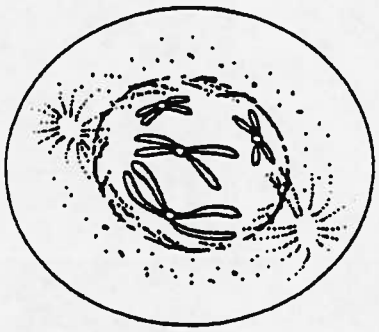
7. Identify the stages of mitosis and explain what happens in each stage.

INTERPHASE:



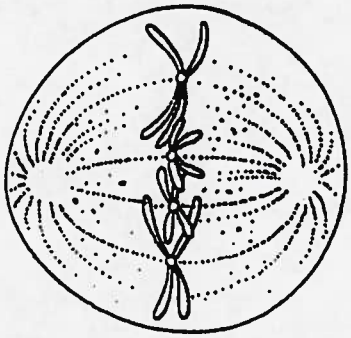
- The cell is doing its **job**
- **DNA** in the form of **chromatin** – cannot be seen
- At the end of interphase the DNA has **replicated**

PROPHASE:



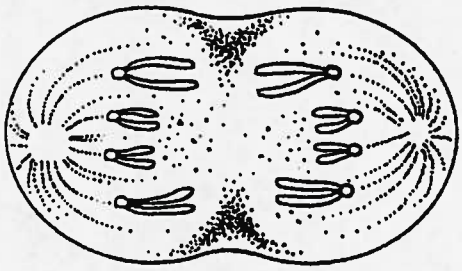
- **Nuclear membrane** disappears
- **Nucleolus** disappears
- DNA **shortens** and **thickens** and becomes visible - **chromsomes**
- **Spindle fibres** form and can be seen
- **Centrioles** move apart

METAPHASE:



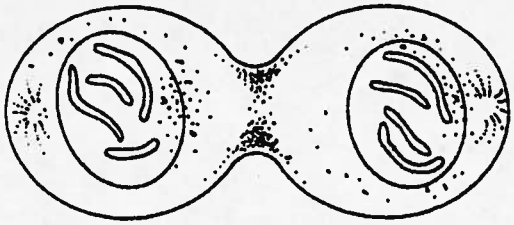
- Chromosomes line up at **equator** of cell
- Centrioles are located at **poles**
- Spindle fibres attach to **centromeres** and centrioles

ANAPHASE:

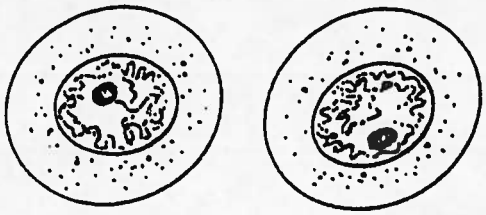


- Centromeres **split** and single-stranded **chromatid** move to opposite poles
- Pulled by spindle fibres

TELOPHASE:



- Opposite of **prophase**
- **Nuclear membrane** reappears
- **Nucleolus** reappears
- **Spindle fibres** disappears
- Chromatid become **longer** and **thinner** and cannot be seen (**chromatin**)



FINAL RESULT OF CELL DIVISION:

- **Cytokinesis** occurs (division of cytoplasm)
- Two **genetically identically daughter** cells

8. What is cancer? What causes it to develop? Define "benign" and "malignant". What are four main mutagens (cancer-causing agents)? How are cancer cells different from normal body cells?

Cancer is when cell division speeds up. Cancer cells divide out of control, use up energy, do not become specialized, interfere with nearby cells and do not die.

Examples of mutagens include – UV, radiation, alcohol, cigarette smoke, viruses, asbestos.

Tumour	Characteristics
Benign	• Cell division is **unchecked** and proceeds at a **moderate** rate • Does **not invade** surrounding cells, but may **push** nearby cells out of the way • Does **not spread** to other parts of the body • Relatively **harmless** unless found in a part of the body, such as the brain, where it may press on other cells
Cancer (Malignant Tumour)	• Cell division is **unchecked** and occurs very **quickly**. Cells spend little time in **interphase** • **Damages and destroys** surrounding cells by invading them • Can **spread** to other parts of the body • May **interfere** with the function of other cells, sometimes resulting in death if the tumour is not destroyed or removed

9. What is the difference between a specialized cell and a stem cell? Where can stem cells be found in humans?

Stem cells have the ability to become any cell in the body; to take on any job. Stem cells are found in embryos and in adults in bone marrow.
Specialized cells are those that have had some of their DNA "turned off" and have a specific job or task to accomplish.

10. Describe the four main types of tissue in the human body.

The human body has four primary kinds of tissue:

Epithelial tissue – covers and protects the body, organs and body cavities

Connective tissue – provides support and holds the body together
Examples: cartilage, bone, fat and blood

Muscle tissue – contains sheets or bundles of muscle cells to produce movement

Nervous tissue – provides communication between all body structures

11. Explain the relationship between cells, tissues, organs, and organ systems.

The human body is structured into **systems**. Recall that cells are the smallest units of life. Cells that are similar in **shape** and **function** work together as **tissue**.

Different types of tissues work together to form **organs**, which carry out particular functions. Examples include, **heart, liver, pancreas** and **stomach.**

Organs cannot do all of the necessary work to sustain the body on their own. They must work together with other organs with related functions (**physiology**) or structures (**anatomy**). This is referred to as an **organ system**.

12. Explain the difference between physical and chemical digestion, and explain where these processes occur in the human body.

Digestion is a complex process, which results in food being broken down into its component molecules. It involves:

Mechanical (Physical) Digestion

- Physically breaking the food into small pieces and mixing it with liquids
- No enzymes are necessary and no energy is released

Chemical Digestion

- Digestive enzymes help split specific chemical bonds holding the food molecules together
- Once split up, molecules must be small enough to be absorbed into the bloodstream and, in turn, into the cells of the body

Physical	Chemical
Mouth (teeth and tongue) Stomach (churning) Intestines (peristalsis)	Mouth (amylase) Stomach (HCl and pepsin) Duodenum (many enzymes)

13. Describe the path that food takes as it passes through the human digestive system. Name the structures and processes that are involved along the way.

Mouth	Food enters Teeth crush and tear Saliva begins chemical breakdown
Esophagus	- Moves food to stomach by peristalsis
Stomach	- Mechanical digestion and chemical digestion
Small Intestine	- Complete chemical digestion and absorb nutrients
Large Intestine Rectum Anus	- Reabsorb water and minerals - Feces stored in rectum - Elimination of waste

14. Describe the path that air takes as it moves through the human respiratory system. Name the structures and processes that are involved along the way.

Part	Function
Nasal Cavity	Filters, warms and moistens air
Trachea	Passage of air to the bronchi Surrounded by cartilage Regulated by the epiglottis
Bronchi	Passage of air to lungs Mucous filters foreign material
Bronchiole	Extensive branching to increase surface area Connects to alveoli
Alveoli	Location for gas exchange Thin membrane surrounded by capillaries
Diaphragm	Thin muscle Regulates the volume of the chest cavity for breathing

15. Describe the path that blood takes as it moves through the human circulatory system (cardiac, pulmonary, and systemic circulation). Name the structures and processes that are involved along the way.

- The route taken by the blood within the heart is called **cardiac circulation.**
- The pathway of the blood from the heart to the lungs is called **pulmonary circulation.**
- The movement from the heart to the rest of the body is called **systemic circulation.**

Part	Function
Atria	Chamber of the heart that collects blood flowing into the heart. The right atrium receives blood from the systemic circulation while the left atrium receives blood from the pulmonary circulation
Ventricle	Chamber of the heart that collects blood to be pumped away from the heart. The right ventricle pumps blood to the pulmonary circulation while the left ventricle pumps blood into the systemic circulation
Septum	The wall that separates the right and left ventricles of the heart
Valves	Regulates blood flow
Aorta	The main blood vessel that carries blood from the heart into the systemic circulation
Pulmonary Artery	The artery that carries blood from the right ventricle of the heart to the lungs
Pulmonary Vein	The vein that carries oxygenated blood from the lungs back to the left atrium of the heart
Superior Vena Cava	The main blood vessel that collects blood from the systemic circulation of the body (upper) and returns it to the right ventricle of the heart
Inferior Vena Cava	The main blood vessel that collects blood from the systemic circulation of the body (lower) and returns it to the right ventricle of the heart

16. Explain the similarities and differences between arteries, veins, and capillaries.

Arteries (usually high O_2, low CO_2)

- Carries blood **away** from the heart to the **body tissues**
- **Thick** and **elastic** walls
- When the walls **expand** then **contract**, they help to **propel** blood through the arteries

Veins (usually low O_2, high CO_2)

- Carries blood **to** the heart from **organs** and **tissues**
- **Thin** and slightly **elastic** walls
- Contain flap-like **valves** to prevent **backflow** of blood – defective valves can cause blood to pool and result in **varicose veins**
- **Muscle contraction** around the veins help to keep the blood moving back to the heart.

Capillaries

- The smallest vessels
- The **arterioles** and **venules** are connected by a network of microscopic capillaries
- **One cell thick** and allow for exchange of materials between cells and the blood by **diffusion**

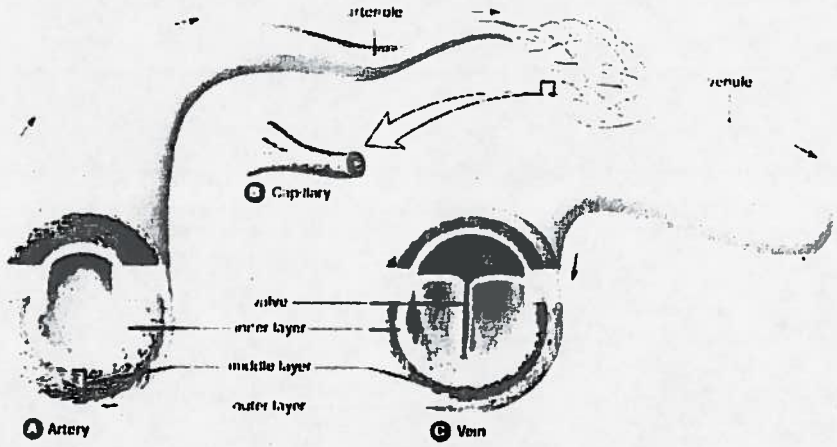


Figure 9.12. Sections through an artery, capillary, and vein. At any given moment, about 30% of the blood in your systemic circulation will be found in the arteries, 5% in the capillaries, and 65% in the veins.

17. What are the main components of blood, and what is the main function of each?

Table 9.2
Cellular components of blood

Point of comparison	Red blood cells	White blood cells		Platelets
		Leucocytes	Lymphocytes	

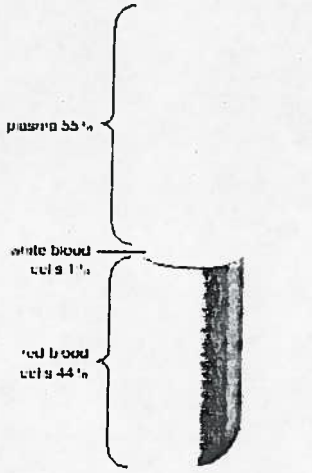


Figure 9.14 A medical device can be used to separate the three main components of the blood. When the blood is separated it settles into layers as shown here.

18. Describe the three main plant tissues and their functions.

The tissues of a plant are:
- Epidermal tissue (covering)
- Ground tissue (storing, support, photosynthesis)
- Vascular tissue (transport)

19. Describe the three main organs of a plant in detail (stems, roots, leaves), and explain the functions of each organ.

Roots

One of the major roles of the root is to **anchor** the plant in the soil and hold the **stem** in place; by doing so, plants also help to prevent **erosion** of the soil. There are two main types of roots, **tap** roots and **fibrous** roots.

The second major role of the root is nutrient transport:

a) Roots absorb water for **photosynthesis**
b) Roots replace water lost by **transpiration**
c) Roots absorb water to maintain **turgor** pressure
d) Roots absorb dissolve **minerals**
e) Roots store **sugars** in the form of **starch**

Stems

Stems play an important role in the **support** (holding the leaves up to the light) and **transport** (water, minerals and sugars) of the plant.

Like the roots and leaves of a plant, the stem is composed of different **tissue** layers. Stems can come in two other major forms; **herbaceous** or **woody**.

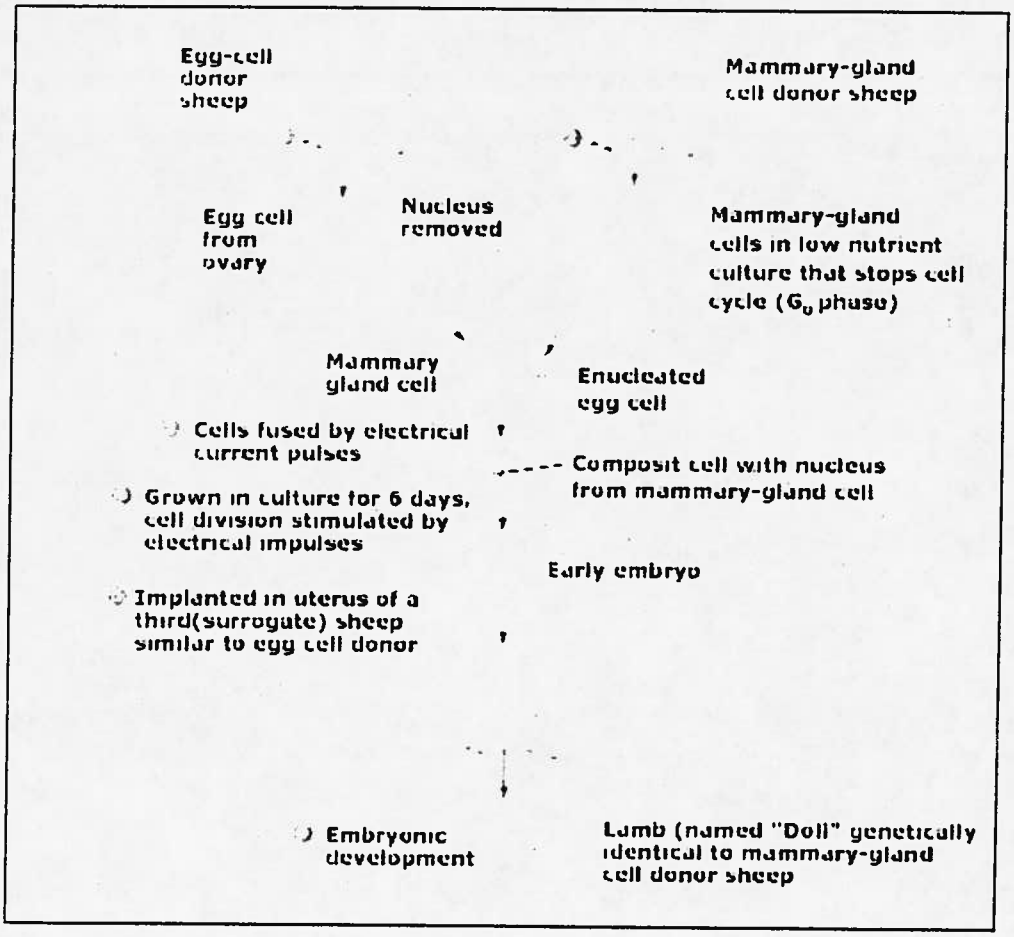
Leaves

Most leaves have a **thin shape** that also allows for easy gas exchange and are **broad** so that sunlight can reach the photosynthetic parenchyma cells. Inside these cells are high concentrations of **chloroplasts**. Chloroplasts are responsible for conducting photosynthesis; the process that takes carbon dioxide from the air and water from the soil and light energy to produce glucose and oxygen.

19. What is genetic engineering? What is cloning? Explain how Dolly the Sheep was cloned.

Genetic engineering is the direct manipulation of **DNA** by humans in a way that DOES NOT occur under **natural conditions.**

Cloning is the process of forming **identical** offspring from a single cell or tissue. It can be natural or brought about by human intervention.



1a) subatomic particles - what is inside an atom?
what is an atom made up of?

p - protons (+ve)

e - electrons (-ve)

n - neutrons (no charge

p + n = nucleus

e - = orbit around nucleus

b) # of protons and # of electrons are the same #
in a neutral atom.

2a) mass # = # protons + # neutrons.

atomic # = # of protons

$^{6}_{12}C$ — 6 - atomic #
12 - mass #

p = A# = 6
e = A# = 6
n = m - A
= 12 - 6
= 6

$^{12}_{24}Mg$

p = 12
e = 12
n = 24 - 12
= 12

b) isotopes - 2 or more forms of an element
that have the same # of protons but
different # of neutrons.
∴ mass # is different

3a) valence electrons - electrons in the outer shell
- the electrons involved in bonding +
chemical rxns

b) valence shell - last energy level with electrons on it

c) items same # valence e's - have similar chemical
+ physical properties

4 periods

a) arrangement by atomic #

b) horizontal rows / periods - Period # = # of energy levels

c) vertical columns - grps / families - grp # = # of valence electrons

d) metals vs non-metals

5a) neutral atom - # of protons = # of electrons
∴ no charge

ion - is an atom with a charge
- either lossed electrons OR
- gained electrons

cation - positive charge
- lost e^-'s

anion - neg charge
- gain e^-'s.

b) atoms form ions in an attempt to have a stable octet
- strive for 8 e^-'s around outer shell except for H
+ He - strive for only 2 e^-'s in outer shell.

c) metals tend to have less than 4 e^-'s ∴ tend to lose e^-'s - forming cations

d) grp # = # of valence elec

grp 1 - 1 valence e^-
∴ loses 1 e^-
result charge +1

grp 17 - 7 valence e^-
∴ gains 1 e^-
result charge -1

non metals have 5 or more e^-'s
∴ tend to gain more e^-'s
∴ form anions.

b) $Na \rightarrow Cl \longrightarrow [Na]^+ [:\ddot{Cl}:]^-$

grp 1 = 1 vale e⁻
metal loses e⁻'s

grp 17 - 7 vale e⁻
Nonmetal gains e⁻'s

c) Ionic compound.

d) ∴ metal + nonmetal forms ionic compounds.

7a) 2 nonmetals share electrons.

b) covalent ~~compound~~ bond.

c) covalent OR molecular compound

$:\ddot{Cl}-\ddot{Cl}: \longrightarrow :\ddot{Cl}-\ddot{Cl}:$

share

covalent bond represents 2 e⁻'s.

Naming.

* Ionic
metal + Nonmetal
/ \
name as is ending "ide"

* Criss cross rule.

Na_2S
+1 -2
sodium sulfide

Covalent
NM + NM
↳ use prefix to indicate # of atoms

mono - 1
di - 2
tri 3
tetra 4
penta 5.
hex - 6
hept 7
oct - 8

CO_2
carbon dioxide

Name

c.

a) Ag_2S - Silver sulfide

b) MgH_2 - magnesium hydride

c) $BeCl_2$ - beryllium chloride

d) Al_2C_3 - aluminum oxide

e) CaF_2 - calcium fluoride

f) MnF_2 - manganese (II) fluoride

g) $NiCl_2$ - nickel (II) chloride

h) Fe_2S_3 - iron (III) sulfide

i) HgO - mercury (II) oxide

j) FeS - iron (II) sulfide

k) KNO_3 potassium nitrate

l) Na_2SO_4 - Sodium sulfate

m) $CaCO_3$ Calcium carbonate

n) $Mg(OH)_2$ magnesium hydroxide

o) $(NH_4)_2O$ - ammonium oxide

p) $Pb_3(PO_4)_2$ - lead (II) phosphate

q) $Cu(OH)_2$ - Copper (II) hydroxide

r) $CrCO_3$ chromium (III) carbonate

s) Hg_2SO_4 - mercury (I) sulfate

t) $Mn(NO_3)_4$ - manganese (IV) nitrate

q sodium sulfide - Na_2S

b) Calcium oxide - CaO

c) magnesium nitride - Mg_3N_2 (+2, -3)

d) potassium phosphide K_3P

e) lithium fluoride LiF (+1, -1)

f) copper (II) oxide CuO

g) lead (IV) chloride $PbCl_4$

h) tin (II) fluoride SnF_2

i) copper (I) oxide Cu_2O (+1, -2)

j) chromium (III) sulfide Cr_2S_3 (+3, -2)

k) sodium bicarbonate $NaHCO_3$

l) zinc phosphate $Zn_3(PO_4)_2$ (+2, -3)

m) lithium sulfate Li_2SO_4 (+1, -2)

n) potassium hydroxide KOH (+1, -1)

o) Beryllium carbonate $BeCO_3$ (+2, -2)

p) lead (IV) sulfate $Pb(SO_4)_2$ (+4, -2)

q) iron (III) nitrate $Fe(NO_3)_3$

r) tin (II) carbonate $Sn(HCO_3)_2$

s) manganese (II) carbonate $MnCO_3$

t) cobalt (III) hydroxide $Co(OH)_3$ (+3, -1)

b) CO_2 carbon dioxide

c) CCl_4 carbon tetrachloride

d) N_2O dinitrogen monoxide

e) BF_3 boron trifluoride

f) N_2O_5 dinitrogen pentoxide

i) CC

j) PH_3

c) SC_2

d) SF_6

e) N_2O_4

f) PCl_5

12. a) Law of Conservation of Mass
- mass of products is always equal to mass of reactants.

b) identify number of atoms/molecules that react or are produced in a rxn

13. a) $4Cu + O_2 \rightarrow 2Cu_2O$ * syn

b) $2NaCl + Br_2 \rightarrow 2NaBr + Cl_2$ * S.D

c) $Sn + 2Cl_2 \rightarrow SnCl_4$ * syn

d) $2H_2S \rightarrow 2H_2 + S_2$ · decomp

e) $2NI_3 \rightarrow N_2 + 3I_2$ · decomp

f) $FeCl_3 + 3NaOH \rightarrow Fe(OH)_3 + 3NaCl$ · D.D

g) $Mg + 2AgNO_3 \rightarrow 2Ag + Mg(NO_3)_2$ * S.D

h) $Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + 2KNO_3$ · D.D

H [illegible] Decomposition

A + B → AB

two or more substances combine to form 1 substance

AB → A + B

one substance breaks up forming more than one substance

c) Single disp

A + BC → AC + B metal replaces metal
+ +- +- +

OR D + EF → ED + F NM replaces nonmetal.
- +-

* one substance replaces another element in a formula

d) double disp

AB + CD → CB + AD
+- +-

* two elements switch places with two elements

16 d) rate of reaction - how fast a rxn proceeds, how long until rxn is completed.

- Affect overall rate

b) - Concentration
  - ↑ concentration, ↑ rate
- Surface area
  ↑ surf. area ↑ rate
- temp - ↑ temp, ↑ rate
- Catalyst - speeds up rxn without being consumed itself.

17. acid - produce H^+ ions

base - produce OH^- ions.

strong acid / strong base
↳ completely dissociate

$HCl \rightarrow H^+ + Cl^-$

* all HCl breaks up into H^+, and Cl^- ions
* strong acid

Properties of Acids

- taste sour
- turn litmus red
- conducts electricity
- pH less than 7
- reacts with metals to produce H_2
- reacts w carbonates - precipitation clear - fizzing/gas Blue-yellow

Properties of Bases

- taste bitter
- feel slippery
- turn litmus blue
- conducts electricity
- pH greater than 7
- precipitation - pink

ranging from 0 - 14,
[illegible] solutions as
acidic, basic + neutral

- reverse logarithmic scale

low pH = high concentration of H^+ ions

high pH = low concentration of H^+ ions

- difference in pH units = 10x
  pH = 1 vs pH = 4
  10 x 10 x 10 x 10
  = 10000x more acidic

b) 3 things pH value represents.

ex pH = 5

- indicate if acid/neutral/base
- indicate if very acidic or slightly acidic
- indicate approx the amt of H^+ ions in solution

19 Acid + Base → neutralize the acidic + basic properties

b) General Equation

Acid + Base → salt + H_2O

H - Acid + B - OH → B - Acid + H - OH
\+ − + − salt (+ −) (H_2O)

cation of base and anion of acid.

ex H_2SO_4 + $Ca(OH)_2$ → $CaSO_4$ + H-OH
\+ − + − (+ −)
Acid Base salt calcium sulfate

c) Neutralization [illegible] Double Replacement

Light and Geometric Optics

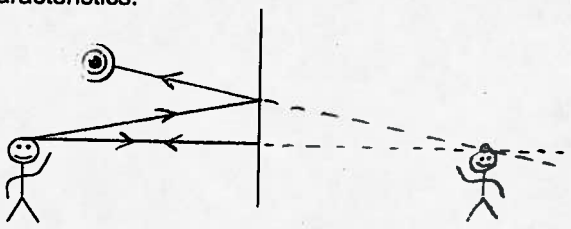
Use the GRASP method for all problems. Fully label all ray diagrams.

1. Review the different sources of light:

Sun – a luminous source of direct light
Incandescence – objects that emit light because they are hot
electric discharge tubes – electricity through a gas causes light emission (fluorescence)
fluorescence – objects emit light when excited by other radiation
luminescence -
phosphorescence – objects emit light when excited and continue to do so once source is removed
chemiluminescence – emit light b/c of a chem. reaction
bioluminescence - living things that emit light b/c of a chem. reaction

2. What is a "ray"? Know how to use rays to demonstrate the behaviour of light.
   - path taken by light energy
   -represented by a solid line with an arrow indicating the direction of travel of light E
3. What are the Laws of Reflection?
   - Angel of incidence is equal to the angle of reflection
   - Incident ray, reflected ray, and the normal all lie in the same plane
4. Define incident ray, angle of incidence, reflected ray, angle of reflection, and normal.
   - Ray approaching mirror is incident ray
   - Ray reflected by mirror is reflected ray
   - Point where the incident ray strikes the mirror is called the point of incidence
   - Construction line drawn at right angles to the mirror at the point of incidence is called the normal
   - Angle between incident ray and normal is called the angle of incidence
   - Angle between the reflected ray and the normal is called the angle of reflection

5. What are the L.O.S.T. characteristics of an image in a plane mirror?
   L – location
   O – orientation
   S – size
   T - type
6. Draw a ray diagram to show the eye's perception of the image in the plane mirror. State the image characteristics.



L: same
O: upright (laterally inverted)
S: same
T: virtual

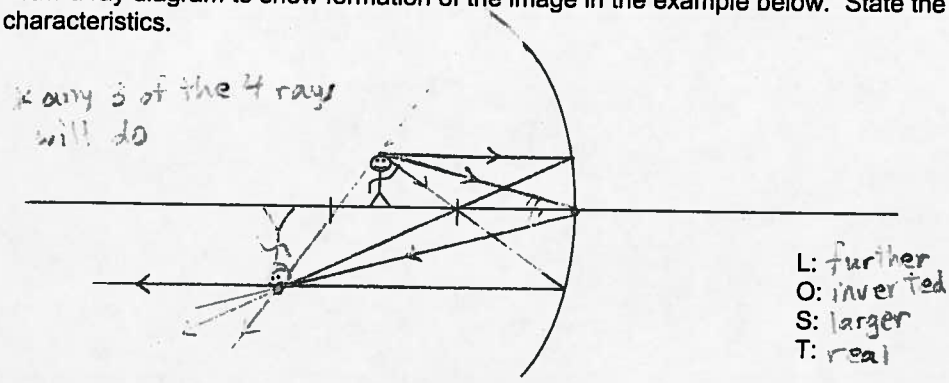
7. What are the L.O.S.T. characteristics of an image in a concave mirror? A convex mirror?
   Concave mirror object between F and C = image is farther, inverted, larger, real
   Concave mirror object at C = image is at C, inverted, same size, real
   Concave mirror object beyond C = image is between C and F, inverted, smaller, real
   Concave mirror object at F = no image
   Concave mirror object between F and V = image is beyond mirror, upright, larger, virtual
   Concave mirror object is at great distance = image is at F, inverted, smaller, real

   Convex mirror = image is always beyond mirror, upright, larger, virtual

8. Define focal point, principal axis, centre of curvature, vertex.

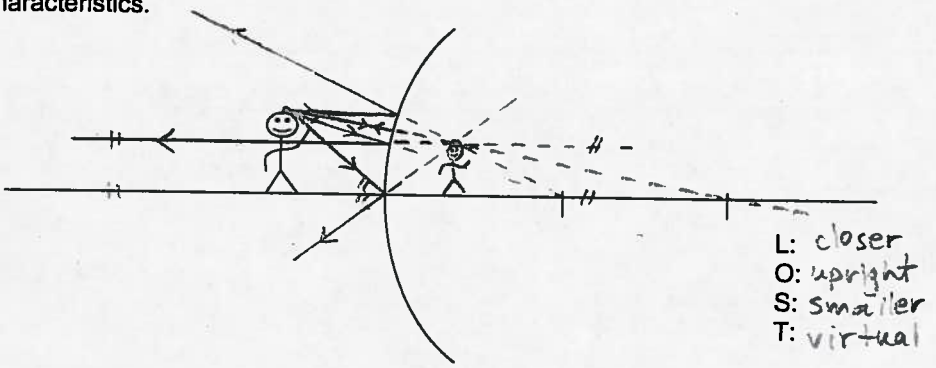
   Focal point = the point at which all parallel incident rays are reflected on the principal axis
   Principal Axis = straight line passing through V and C
   Centre of Curvature = centre of a curved reflecting surface
   Vertex = geometric centre of the a curved mirror

9. Draw a ray diagram to show formation of the image in the example below. State the image characteristics.



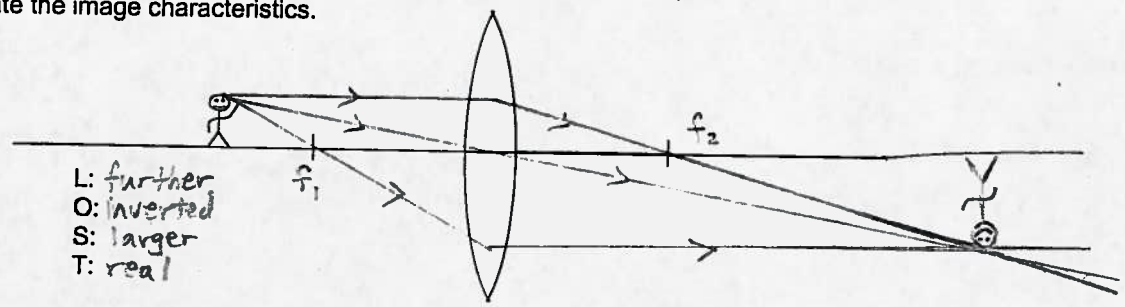
L: further
O: inverted
S: larger
T: real

10. Draw a ray diagram to show formation of the image in the example below. State the image characteristics.



L: closer
O: upright
S: smaller
T: virtual

11. Draw a ray diagram to show formation of the image in the example below. State the image characteristics.



12. Describe an everyday application of a concave and a convex mirror.
    Convex = truck mirror
    Concave = solar furnace
13. What is the difference between a real image and a virtual image?
    Real = image can be formed on a screen
    Virtual = image cannot form on a screen

14. Calculate the magnification of a concave mirror if the image of a 20cm-long pencil is found to be 30cm in height. [1.5]
15. An object 65cm tall is placed 105cm in front of a mirror with a focal length of -90cm.
    a) What type of mirror is this?
    b) Calculate the image distance. [-48.46cm]
    c) Calculate the image height. [30cm]
    d) Describe the image (L.O.S.T.).
16. A 15cm-long pencil is located 25cm in front of a concave mirror with a focal length of 20cm.
    a) What will be the distance of the image from the mirror? [100cm]
    b) What will be the height of the image? [60cm]
17. What happens to light when it crosses from one medium to a different medium?
    If light enters a medium at an angle (ie not zero or not 90) with a different optical density (different index of refraction), it will bend. If the medium that it enters is less dense, light will bend away from the normal. If the medium that it enters is more dense, light will bend toward the normal.
18. Define refraction, refracted ray, angle of refraction, and index of refraction.
    Refraction = change of direction In light as it passes at an angle from one medium to another
    Angle of refraction = angle between the refracted ray and the normal
    Refracted ray = ray that is bent because the medium has a different optical density
    Index of refraction = ratio of speed of light in a vacuum to the speed of light in a given material (higher n value means greater optical density)

19. The index of refraction in crystal glass is 1.54. Calculate the speed of light in crystal.
    [1.95×10^8 m/s]
20. If the speed of light in a diamond is 1.24×10^8 m/s, what is the index of refraction for diamond? [2.42]