Midterm 1 Practice Questions

Section A - Definitions/Fill in the Blanks (1 mark each)

A _____polar____ _____covalent_____ bond, is a strong bond in which the two atoms share a pair of valence electrons unequally due to one atom being more electronegative than the other.

_____cytosol_____ is the jelly-like filling of the cell in which other cellular components are found.

The _____**lysosome**____ is an organelle which acts as the digestive compartment within the cell.

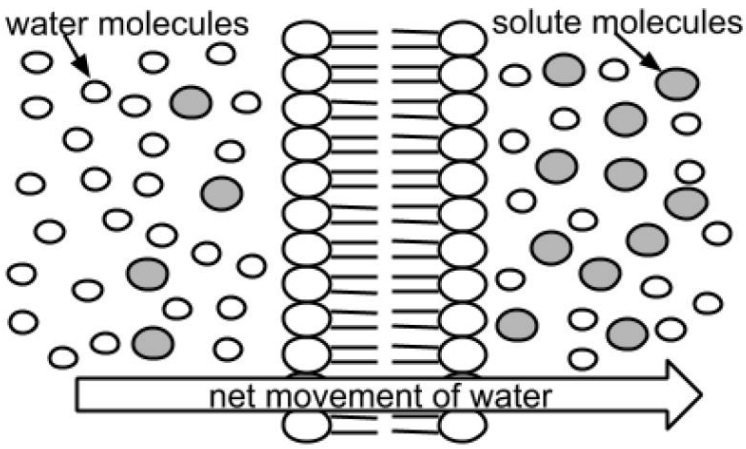
Electronegativity is the term which refers to an atom's attraction for the electrons in a chemical bond.

When assembling the three polymeric macromolecules, the monomers are joined via a **dehydration or polymerization** reaction and can be separated by a **hydrolysis** reactions.

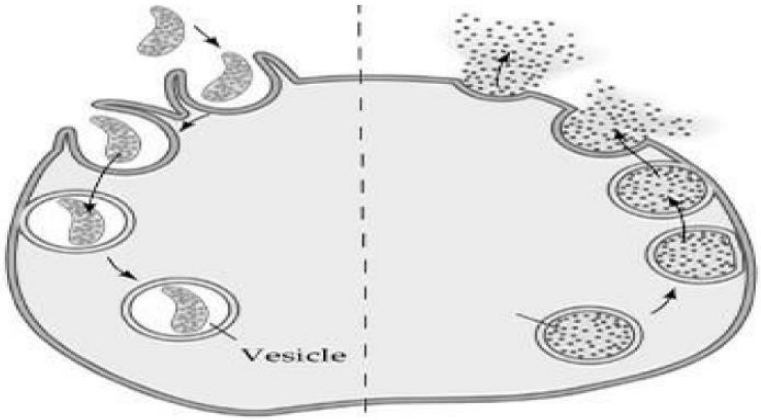
Diffusion is the tendency for molecules to spread out evenly into the available space.

Section B – Short Answers

1) Briefly describe what is happening in each of the following images (1 mark each):



osmosis – diffusion of water across a membrane



Left side - phagocytosis - import of large solid particles into the cell

Right side – exocytosis – bulk export from the cell

2) Name 3 types of microscopes and briefly why a biologist might use each one (6 marks).

1 mark per type of microscope and 1 mark per explanation X3 *note these are general explanations, specific examples would be acceptable here

Light microscope – to examine the general size/shape of cells (more detailed analyse can be completed with the addition of dyes or phase contrast)

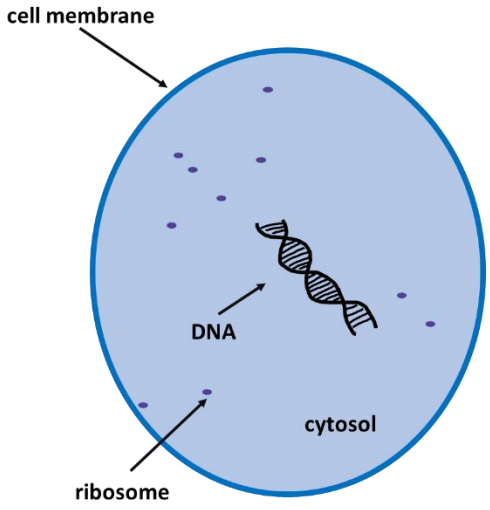
Fluorescence microscope – to visualize fluorescently labeled structures within a cell

Confocal microscope – fluorescently labeled structures within a cell with greater resolution than a regular fluorescence microscope and/or to add 3-dimensional analysis of this structure (use of super-resolution technologies could further increase the resolution)

Scanning electron microscope – to examine in great detail (with excellent resolution) the contours of a structure (often the external surface)

Transmission electron microscope – to examine fine details of the internal structures of a cell

3) Draw and label a cell which has all of the characteristics common to all types of cells (5 marks). 1 mark per feature + 1 mark for the drawing itself



4) True or False. Justify your response only if false. (7 marks). 1 mark each

- Prokaryotic cell are typically much smaller than eukaryotic cells. ___T_____
- In eukaryotic cells DNA is only found in the nucleus __F___ mitochondria and chloroplasts also have their own circular DNA molecules
- Vacuoles are found only in plant cells __F___ Only plant cells have a central vacuole but ALL cell types have vacuoles in varying quantities and sizes
- A protein destined to be a transmembrane, integral membrane protein at the plasma membrane will be found floating freely within the lumen of the vesicle which transports it from the Golgi body to the cell surface ____F___ the protein described in the above would be a secreted protein, an integral transmembrane protein would be embedded in the vesicular membrane
- Cell membranes are symmetrical __F____ the lipid leaflets have different phospholipid composition, glycolipids/glycoproteins only found on the outside, each leaflet anchors the cell differently (to the cytoskeleton vs the ECM)
- All types of cytoskeleton fibers associate with motor proteins to facilitate cell motility __F____ only microtubules and microfilaments associate with motor proteins, intermediate filaments do not associate with motor proteinns
- Only prokaryotic cells have flagella ___F___ Flagella are observed more frequently as part of prokaryotic cells but some eukaryotic cells also use them for motility (e.g. – sperm and various single celled organisms such as algae)

5) Complete the following table (14 marks).

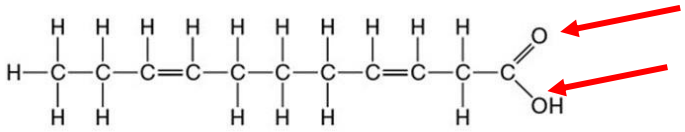
Organelle	**# of membranes which surround it**	**Briefly describe the function of this organelle**
Nucleus	2	Repository for the cell's genetic information
Lysosome	1	Digests
Mitochondria	2	Carries out oxidative metabolism to produce ATp
Nucleolus	0	rRNA synthesis and assembly of ribosomal subunits
Ribosome	0	Produces proteins (also accept carries out translation)
Chloroplast	2	Harnesses light energy to produce ATP via photosynthesis
Golgi apparatus	1	

		Receives lipids and proteins produced by the ER, glycosylates lipids (modifies , sorts and packages them for export to other cellular locations via vesicles

6) Identify two (2) reasons why weak chemical bonds are important in biological systems. (2 marks) 1 mark per reason

- reinforce shapes of molecules (e.g. secondary and tertiary structure of proteins)
- help molecules adhere to each other
- their reversibility can be advantageous (e.g. - reversible interaction b/w drugs and receptors)
- Weak chemical bonds 'add up' to create strong interactions

7) The molecule depicted below is a(n) ____unsaturated_____ (saturated or unsaturated) fatty acid (1 mark).



Indicate with an arrow, the most electronegative atom(s) present. (1 mark)

Name the biologically important functional group which is part of this molecule ___carboxyl_____ (1 mark)

Would you expect to find this fatty acid in a high percentage of membrane phospholipids in a fish living in a hot or cold climate? ___cold_____. Why? (2 marks)

Helps keep their membranes fluid despite external temp.

8) Name and briefly describe two (2) functions that a protein might play in the cell. (4 marks)

1 mark per name and 1 per function

Type	Functions
Digestive enzymes	Help in digestion of food by catabolizing nutrients into monomeric units
Transport	Carry substances in the blood or lymph throughout the body
Structural	Construct different structures, like the cytoskeleton
Hormones	Coordinate the activity of different body systems
Defense	Protect the body from foreign pathogens
Contractile	Effect muscle contraction
Storage	Provide nourishment in early development of the embryo and the seedling

9) Describe what type(s) of amino acids you would expect to find on the outer surface of a protein which floats freely in the cytoplasm? What type(s) of AAs would you expect to find within the inner mass of that protein? Briefly explain your rationale. (**3 marks**)

0.5 marks per type/place and 1 mark per explanation

Outer surface = hydrophilic amino acids (from the polar and charged families) because they would contact the cytoplasm which is aqueous (polar)

Inner mass = hydrophobic amino acids (non-polar amino acids) because they are shielded from the aqueous environment

10) Connect they cytoskeleton with its protein building block (3 marks)

Cytoskeleton Fiber Type	Protein Building Block
A. Intermediate filament	_C___ tubulin
B. Microfilament	A kertain
C. Microtubule	_B___ actin

11) Complete the following table about intercellular junctions (3 marks)

Junction Type	Function
Gap junctions	**Provides a direct channel of communication between 2 adjacent cells**
plasmodesmata	**Provide direct channels of communication between plant cells**
Tight Junctions	**Forms a watertight seal between 2 cells**

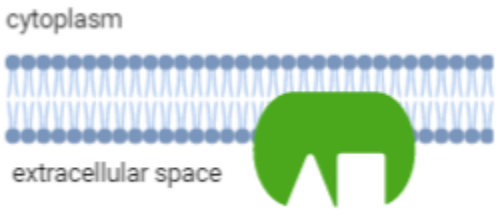
12) Describe what would happen to red blood cells if you were given an IV (intravenous) infusion of pure water and briefly explain why. (**2 marks**)

What - The red blood cells would rupture. (1 mark)

Why - Pure water is a hypotonic solution (it has less/no salt) which would cause the water to enter into the cells in an attempt to equilibrate their higher salt concentration. Upon entry of too much water the plamsa membrane would lyse/rupture. (1 mark)

1313) a) An integral membrane protein extends from partway through the vesicular membrane into the internal compartment of the vesicle. This vesicle travels to and fuses with the cell's plasma membrane. Draw the protein where it would be located within the plasma membrane. Don't forget to label each side of the membrane. (3 marks)

1 mark for protein that is integral but NOT transmembrane
1 mark for protein facing the extracellular side
1 mark for labels



b) Does this protein have a hydrophobic domain? Justify your response. (1 mark)

Yes it must have at least one hydrophobic domain as it is integral/embedded in the membrane meaning that it must come into contact with the fatty acid tails of the phospholipids which are also hydrophobic.