Section A – MCQ

1. 4	6. 2	11. 5	16. 1	21. 3
2. 3	7. 3	12. 4	17. 2	22. 3
3. 1	8. 1	13. 3	18. 2	23. 1
4. 2	9. 1	14. 2	19. 5	24. 4
5. 1	10. 2	15. 1	20. 2	25. 4

Section B – MCQ

1. 4	6. 2	11. 5	16. 2	21. 3
2. 4	7. 3	12. 4	17. 2	22. 3
3. 1	8. 1	13. 3	18. 1	23. 1
4. 2	9. 1	14. 2	19. 5	24. 4
5. 1	10. 2	15. 1	20. 2	25. 4

Section C – MCQ

1. 4	6. 2	11. 5	16. 1	21. 3
2. 2	7. 3	12. 4	17. 2	22. 3
3. 1	8. 1	13. 3	18. 1	23. 1
4. 3	9. 1	14. 2	19. 5	24. 4
5. 2	10. 2	15. 1	20. 2	25. 4

Student #: _____

Section A

1. Fill in the blank to complete each of the following sentences. (1 mark each – total **7 marks**)

a) The smallest collection of matter that can be considered alive is the ____**cell**_____.

b) Proteins modified with covalently linked carbohydrates are called _____glycoproteins_____.

c) _____van der walls interactions_____ are the type of bond or interaction which forms only when atoms are physically close and their electrons are not symmetrically distributed.

d) A _____**contractile** vacuole_____ pumps excess water out of cells; a process which allows some organisms to carry out osmoregulation.

e) Molecules which contain both a hydrophobic and a hydrophilic region, such as phospholipids, are also known as _____amphipathic_____ molecules.

f) A type of transport protein that generates voltage across a membrane is also known as a ___electrogenic OR Na^+/K^-/proton (H+)_____ pump.

g) _____carbohydrates_____ are the class of macromolecules which consist of both monosaccharides and the polymers built from them.

Section B

1. Fill in the blank to complete each of the following sentences. (1 mark each – total **7 marks**)

a) Chemical and physical processes on early earth may have produced very simple cells through a sequence of events, this included the development of _____protocells_____ or fluid filled compartments enclosed by a membrane-like structure.

b) Lipids modified with covalently linked carbohydrates are called _____glycolipids_____.

c) _____van der walls interactions_____ are the type of bond or interaction which forms only when atoms are physically close and their electrons are not symmetrically distributed.

d) A _____contractile vacuole_____ pumps excess water out of cells; a process which allows some organisms to carry out osmoregulation.

e) The process by which some cells can engulf another cell forming a food vacuole is known as _____phagocytosis_____.

f) Molecules which contain both a hydrophobic and a hydrophilic region, such as phospholipids, are also known as _____amphipathic_____ molecules.

g) A type of transport protein that generates voltage across a membrane is also known as a ___electrogenic_____ pump.

Student #: _____

Section C

1. Fill in the blank to complete each of the following sentences. (1 mark each – total **7 marks**)

a) The smallest collection of matter that can be considered alive is the ____**cell**_____.

b) Proteins modified with covalently linked carbohydrates are called _____glycoproteins_____.

c) .

d) A _____contractile vacuole_____ pumps excess water out of cells; a process which allows some organisms to carry out osmoregulation.

e) The process by which some cells can engulf another cell forming a food vacuole is known as _____phagocytosis_____.

f) Molecules which contain both a hydrophobic and a hydrophilic region, such as phospholipids, are also known as _____amphipathic_____ molecules.

g) A type of transport protein that generates voltage across a membrane is also known as a ___electrogenic_____ pump.

h) _____carbohydrates_____ are the class of macromolecules which consist of both monosaccharides and the polymers built from them.

Section A & C

2. Fill in the blank to complete each of the following sentences. (1 mark each – total **3 marks**)

In their journey through the endomembrane system, vesicles destined for the plasma membrane bud off of the ___trans___ face of the Golgi apparatus. An integral membrane protein which will be exposed only on the cytoplasmic side of the plasma membrane, would be embedded in ____outer_____ leaflet of the lipid bilayer of the vesicle shuttling it to the plasma membrane. These vesicles merge with the plasma membrane where they release their content into the extracellular space in a type of bulk transport known as _____exocytosis_____.

Section B

2. In their journey through the endomembrane system, vesicles destined for the plasma membrane bud off of the endoplasmic reticulum and fuse with the ___cis___ face of the Golgi apparatus. An integral membrane protein which will be exposed only on the extracellular side of the plasma membrane, would be embedded in ____inner_____ leaflet of the lipid bilayer of the vesicle shuttling it to the plasma membrane. These vesicles merge with the plasma membrane where they release their content into the extracellular space in a type of bulk transport known as _____exocytosis_____.

Student #: _____

3. Identify 2 pieces of evidence biologist use to support the endosymbiotic theory. (**2 marks)**

Evidence (**1 mark each for any 2 of the following points)**

- Size of mitochondria/chloroplasts ≅ the size of a prokaryote
- Bound by two outer membranes
- Grow and reproduce independently in cells using prokaryotic-like mechanisms
- Contain their own circular DNA molecules
- Contain free ribosomes to synthesize protein

4. Name one trace element and using a specific example describe why it is necessary for life. (**2 marks**)

One mark for identifying the element and **one mark** for the explanation

- **Iron (Fe)** – necessary of O_2 transport as part of hemoglobin
- **Iodine (I)** – necessary for hormone production in the thyroid
- **Copper (Cu)** – necessary for many metabolic enzymes (including those needed to metabolize iron)

5. Draw a small patch of the plasma membrane which includes; all types of lipids commonly found in animal cell membranes, one glycolipid, and one integral membrane protein which participates in facilitated transport across the membrane. **(5 marks)**

One mark for each element and one mark for glycolipids located on extracellular side. If the artistic rendering is not of sufficient quality you to determine if these elements are present without a label and you are guessing what you are looking at, you should NOT award the student that mark.

Phospholipid should be drawn as a ball with 2 sticks, in a bilayer format with the fatty acids pointing towards one another

Cholesterol - drawn within the membrane between the phospholipids (so long as there is one cholesterol drawn give them the point but ideally it should be in both leaflets) - they do not need to get the carbon backbone structure correct - so long as they draw something in the correct location and clearly indicate that this is their representation of cholesterol (i.e. - by including a legend or directly labeling the diagram) they should be awarded the point

Glycolipid/glycoprotein (differs by section) - a string like structure attached to either a protein or lipid

Integral Membrane Protein - needs to pass through both layers of the phospholipid bilayer, can be either a channel protein (likely represented as a cylindrical shaped protein with a channel drawn through it or an arrow across it representing the movement of molecules) or a carrier protein (protein open to only one side or the other of the membrane. There should be no depiction of ATP/energy use in relation to these channels.

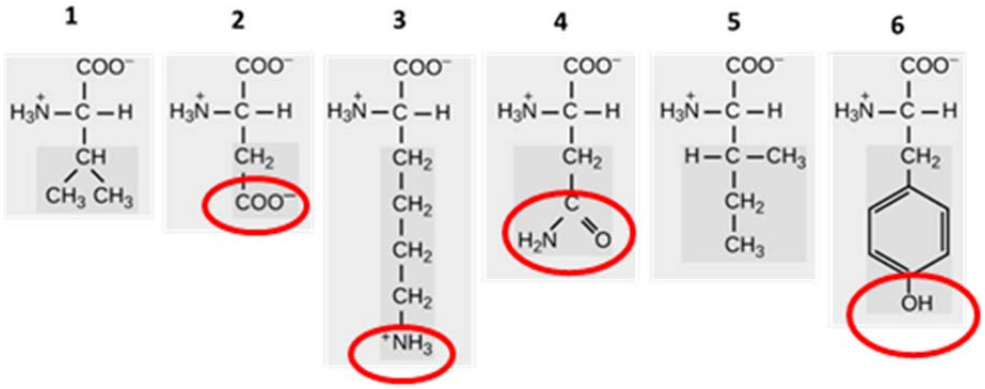
Student #: _____

6. The plasmodesmata of plant cells are most similar to which type of intercellular junction found in animal cells? Provide a brief justification for your answer. (**2 marks)**

Gap Junctions (1 mark)

Why (1 mark) both types of junction create a pore between cells and allow for the passage of molecules from cytoplasm to cytoplasm of adjacent cells

7. Compare the following amino acids:



i) List those that you determine to be polar. (**2 marks**) _____ each correct answer is worth 0.5 marks, each incorrect answer deduct 0.5 marks _____

ii) Draw/label directly on the polar molecules what contributes to their polarity to justify your choices above. (**2 marks**)

See above. 0.5 marks for each correctly labelled aa. Partial marks should be awarded as follows:

- aa.#2
  - circled only C in the COO- = 0 marks
  - circled only O in the COO- = 0.25 marks
  - circled only O- in the COO- = 0.25 marks
  - both O and O- or COO- = 0.5 marks (full marks)
- aa.#4
  - circled only C in the COO- = 0 marks
  - circled on N only OR O only = 0.25 marks
  - circled on N and O = 0.5 marks (full marks)

Section A & C

iii) In a protein found floating freely within the cytoplasm, where would you expect to find these polar molecules. (**1 mark**) _____on the outer surface of the protein_____

Student #: _____

Section B

iii) In a transmembrane protein found embedded in the plasma membrane, where would you expect to find these polar molecules. (**1 mark**) _____ on the inside of the protein or on the portion of the protein exposed to the aqueous environment (cytoplasm or extracellular fluid) either answer should be given the point

8. Complete the following table about protein structure. **(8 marks)**

Level of protein structure	**Briefly describe what forms this level of structure**	**Type(s) of bond that allows it to form**
primary	**AA sequence**	**Peptide bond**
secondary	Interaction between components of the peptide backbone (alpha helices and beta pleated sheets)	Hydrogen bonds
tertiary	Interaction between side chains (R groups)	**(must name a min of 2 types) – award mark each** • H bonds, • Hydrophobic / van der walls interactions, • disulfide bridges, • ionic bonds
quaternary	**Interaction between polypeptide chains**	**NOT AVAILABLE**

Student #: _____

9. Which of these associations are a correct match? Justify your answer in each case. **(6 marks)**

0.5 marks for each T/F answer and **1 mark** per justification

Association	True (T) or False (F)	Briefly justify your answer
Microfilaments and the nuclear lamella or 'cage'	F	It is the intermediate filaments which encase the nucleus OR Microfilaments are involved with structure and transport
Microtubules and chromosome separation during mitosis	T	Microtubules generate the mitotic spindle which segregates the chromosomes (or – end of microtubules are attached to the centrosome/centrioles which separates at cell division)
Intermediate filaments and myosin	F	Myosin is a motor protein that associates with actin microfilament OR Intermediate filaments are not associated with motor proteins
Microfilaments and flagellar motion	F	Microtubules move the flagella OR microfilaments are involved with vesicle transport.

Student #: _____

10. Complete the table below using the following figure: **(10 marks)**

1 mark per name and 1 mark per description (they don't need to say everything in the description to get the mark but if they only mention one thing it should be the bolded function)

Section A & B

Label	Name the structure	Briefly describe the role of the structure
A	Golgi	**Sorts and packages materials into transport vesicles**, modifies products from the ER, manufactures carbohydrates
B	nucleolus	**rRNA synthesis** and ribosome assembly
C	Centrosome / centriole**s**	**Microtubule organizing center** (or where microtubules grow out of) (marks for referring to mitosis)
D	mitochondria	**Cellular respiration** (generates ATP from macromolecules)
E	Smooth endoplasmic ER	**Synthesizes lipids**, Metabolizes carbohydrates, **Detoxifies drugs and poisons**, Stores calcium ions (**either bolded answer is acceptable on its own**)

Student #: _____

Section C

Label	Name the structure	Briefly describe the role/function of the structure
A	Nucleolus	**rRNA synthesis** and ribosome assembly
B	Rough endoplasmic reticulum	**Synthesis of proteins** and generation of transport vesicle to move molecules to the golgi
C	Central vacuole	**Storage** - hold organic compounds and water OR maintains cell structure
D	Chloroplast / Thalykoid	**Photosynthesis**
E	Golgi apparatus	**Sorts and packages materials into transport vesicles**, modifies products from the ER, manufactures carbohydrates

BONUS QUESTION

Connect the cell part to the disease in which it is dysfunctional (you must get all 4 correct to be awarded **2 marks**)

Award 2 marks if all answers are correct. Answers for Section A, B and C are the same as presented, but have different structures and disorders.

Structures	Disorder (write the letter corresponding to the associated structure)
A. flagella	__D_____ Alzheimer's Disease
B. mitochondria	___A____ male factor infertility
C. vacuoles	____B___ Congenital Lactic Acidosis
D. cytoskeleton	_____C__ Danon's disease