Unit 2 review – Answer Key

1 D	26 B	51 D
2 B	27 A	52 A
3 D	28 A	53 A
4 C	29 A	54 B
5 E	30 *	55 D
6 C	31 *	56 A
7 C	32 *	57 A
8 C	33 *	58 B
9 C	34 *	59 D
10 *	35 C	60 C
11 *	36 D	61 C
12 A	37 A	62 *
13 C	38 C	63 B
14 D	39 B	64 B
15 B	40 B	65 *
16 B	41 *	66 B
17 B	42 C	67 C
18 B	43 B	68 E
19 D	44 A	69 B
20 B	45 A	70 A
21 A	46 A	71 A
22 B	47 B	72 C
23 C	48 C	73 A
24 D	49 C	74 E
25 B	50 C	75 D
		76 B

Written Response Questions:

10. a) Describe ONE characteristic of the plasma membrane that allows estrogens to passively cross the membrane.

Description (1 point)

- ***Hydrophobic/nonpolar***
- ***Space between phospholipids***

11. In a laboratory experiment, a researcher generates antibodies that bind to purified estrogen receptors extracted from cells. The researcher uses the antibodies in an attempt to treat estrogen-dependent cancers but finds that the treatment is ineffective. Explain the ineffectiveness of the antibodies for treating estrogen-dependent cancers.

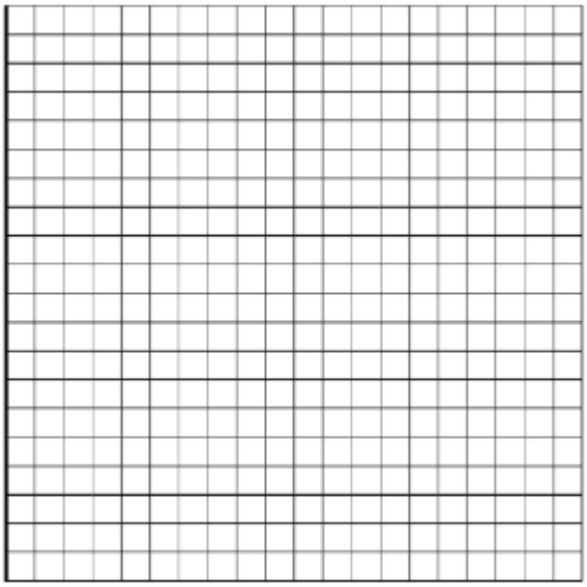
Explanation (2 points)

• Antibodies are unable to enter the cell.

• (Extracellular) antibodies will not bind to (intracellular) estrogen receptors.

30. Graph these data on the axes provided. From your graph, find the apparent molar concentration (osmolarity) of the potato core cells.

Molarity of Sucrose in Beaker	Percent Change in Mass
0.0 *M*	18.0
0.2	5.0
0.4	-8.0
0.6	-16.0
0.8	-23.5
1.0	-24.0



3 points maximum

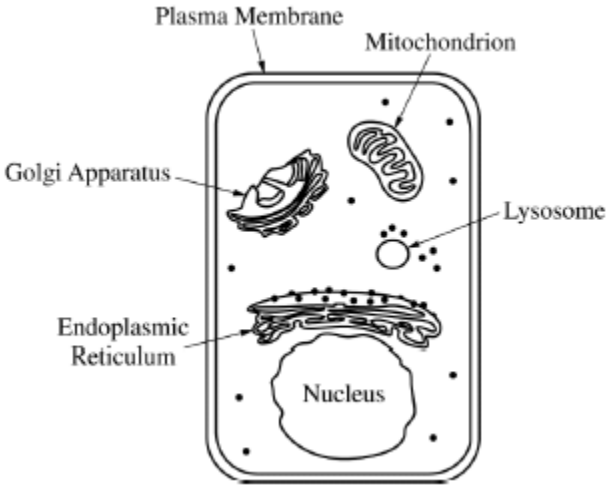
Orientation of axes, labels, scales, units. Data points (one mistake permitted) and line drawn. Determine molar concentration of potato cells. (Note: This point must be read from graph. It should fall into the range of 0.25 to 0.4M.)

31. Predict what would happen to typical animal cells placed in 0.0 M and 1.0M sucrose solutions, and explain your prediction.

4 points maximum:

	Prediction	**Explanation**	
0.0 *M*	Gain water/mass Swell/burst/lyse	• Cell is hypertonic to sucrose solution. • Sucrose solution is hypotonic to cell. • Water potential is greater in 0.0 *M* environment. • No cell wall. • Cell moving toward equilibrium (isotonic).	2 points maximum
1.0 *M*	Lose water/mass Shrivel/crenate	• Cell is hypotonic to sucrose solution. • Sucrose solution is hypertonic to cell. • Water potential is greater inside animal cell. • Cell moving toward equilibrium (isotonic).	2 points maximum

32. Identify the most likely cellular location of a mutant CFTR protein that has an amino acid substitution in the ATP-binding site.



1 point maximum. Identification (1 point)

• In the (cellular/plasma) membrane

33. Identify the most likely cellular location of the ribosomes that synthesize CFTR protein.

1 point maximum. Identification (1 point)

• (Rough) Endoplasmic Reticulum/ER

34. Identify THREE macromolecules that are components of the plasma membrane in a eukaryotic cell and discuss the structure and function of each.

6 points maximum; 1 point for each macromolecule + structure, 1 point for each macromolecule + function

NOTE: Only first three molecules mentioned will be scored.

Macromolecule	Structure	Function (must match selected macromolecule)
Phospholipids OR Lipid with phosphate	• Glycerol, two fatty acids, and polar head group w/phosphate • Amphipathic • Hydrophilic or polar (head) and hydrophobic or nonpolar (tails) • Forms a lipid bilayer	• Selectively permeable • Fluidity • Creates compartment/ separates cell from environment; barrier • Signals, inositol pathway (IP3) diacylglycerol (DAG)
Cholesterol	• Ring structure • Steroid • Amphipathic • Embedded in bilayer	• Moderates fluidity • Stabilizes membrane
Proteins OR The following specific types must indicate that they are proteins Integral Peripheral Pump Receptor Transport Recognition Tight junction Desmosomes Gap junctions Integrins Enzyme Channel	General Structure • Polypeptides; amino acids • 2°, 3°, 4° structure description Specific Structure • Integral, transmembrane, embedded; forms a channel • Peripheral, on surface • Structure fit to substrate or ligand	• Transport • Enzyme, catalysis • Signal transduction • Attachment: extracellular matrix (ECM)-cytoskeleton • Recognition • Cell junction
Glycolipid/Glycoprotein	• Carbohydrate (chains) linked to lipid/protein	• Cell recognition • Attachment to external molecule or another cell

41. The relationship of structure to function is one of the major themes in biology. For three of the following structure/function pairs, describe the structure and then explain how the function is related to the structure.

    Membrane protein structure/active transport or facilitated diffusion:

    4 points maximum

Description (2 points)

- *Phospholipid bilayer (credited unless already described in c)*
- *Integral protein in membrane Protein's 3-D shape allows it to act as a channel, bind solutes, and/or bind ATP, as necessary*

Explanation (2 points)

- *Some solutes, like ions and larger hydrophobic molecules cannot cross phospholipid membranes unassisted.*
- *Integral proteins allow such substances to pass: hydrophilic channel; binding of solute leads to shape change in protein.*
- *Hydrolysis of ATP causes shape change in protein leading to shuttle of material from one side of membrane to the other.*

62. Glucose and sodium move from the lumen of the small intestine into the blood via transport proteins in the epithelial cells lining the small intestine (Figure 1). Based on Figure 1, describe the direct source of energy used to move glucose into the epithelial cell from the intestinal lumen. Explain how this system maximizes glucose absorption from the intestinal lumen into the epithelial cells and from the epithelial cells into the blood.

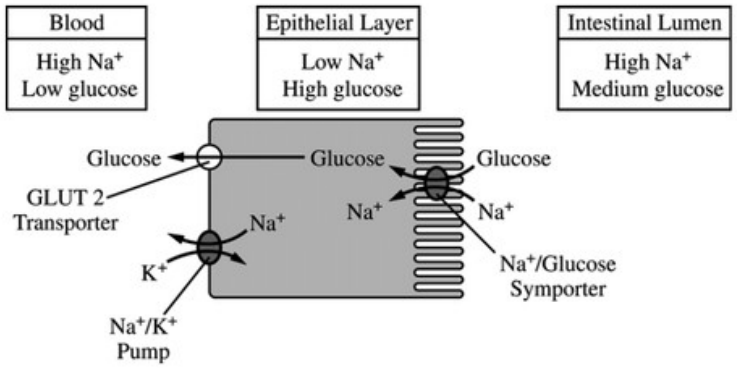


Figure 1. A single cell from the epithelial layer lining the intestine, illustrating movement of glucose and Na+ from the intestinal lumen to the blood

General 3 point(s) maximum Description (1 point each)

- *Energy from the sodium gradient Explanation (2 points maximum)*
- *The Na+ /K+ pump maintains the sodium concentration gradient and allows for the cotransport of glucose*
- *The symport/inflow of glucose maintains a glucose concentration gradient between the epithelial cells and the blood and allows for (facilitated) diffusion of glucose*
- *The microvilli/folds on the lumen side of the epithelial cell provide more surface area for uptake of glucose into the epithelial cell*

65. The following data were collected by observing subcellular structures of three different types of eukaryotic cells.

RELATIVE AMOUNTS OF ORGANELLES IN THREE CELL TYPES

Cell Type	Smooth ER	Rough ER	Mitochondria	Cilia	Golgi Bodies
X	Small amount	Small amount	Large number	Present	Small amount
Y	Large amount	Large amount	Moderate number	Absent	Large amount
Z	Absent	Absent	Absent	Absent	Absent

Based on an analysis of the data, identify a likely primary function of each cell type and explain how the data support the identification.

Identification & Explanation 3 points are earned maximum

Cell Type	**Identify function**		**Explain how data support identification (1 point each correct pair). NOTE: No points for identification without explanation.**		
X	• Locomotion • Movement / surface transport	**AND**	Has cilia for movement and large amounts of mitochondria to provide energy for locomotion of cell itself (ciliated protist) or movement of particles (mucus /oocyte) along cell surface		
Y	• Secretion / exocytosis • Protein synthesis	**AND**	Has large amounts of rough ER and Golgi to produce and package proteins		
	• Lipid/hormone synthesis • Detoxification	**AND**	Has large amounts of smooth ER to produce lipids / hormones		
Z	• Transport	**OR**	• Oxygen transport in animal cells • Water transport in plant cells	**AND**	Does not require these organelles
	• Protection	**OR**	• Epidermal cells (stratum corneum, cork, nails)	**AND**	
	• Support	**OR**	• Ground tissue (schlerenchyma) • Vascular tissue (xylem)	**AND**	
	• Storage	**OR**	• Maximizes volume / space available (hemoglobin, oxygen)	**AND**	
	• No function	**OR**	• Is a dead cell/is undergoing apoptosis	**AND**	