

Exam Memory Bank

$V_0 = \frac{V_{\max} \times [S]}{K_m + [S]}$ $V_{\max} = k_{\text{cat}} \times E_t$ $k_{\text{cat}} = \frac{kT}{h} \times e^{\frac{-G^\ddagger}{RT}}$ $\Delta G = \Delta H - T\Delta S$	$\Delta G^\ddagger = -nF\Delta E^\ddagger$ $\Delta G^\ddagger = -RT \ln K_{\text{eq}}^\ddagger$ $\Delta G_t = RT \ln \frac{c_2}{c_1}$ $\Delta G_t = RT \ln \frac{c_2}{c_1} + ZF\Delta\psi$	$R = 8.314 \text{ J/mol}\cdot\text{K}$ $F = 96,500 \text{ J/V}\cdot\text{mol}$ Boltzman constant, $k = 1.381 \times 10^{-23} \text{ J/K}$ Plank's constant, $h = 6.626 \times 10^{-34} \text{ J}\cdot\text{sec}$ Avogadro's number, $6.02 \times 10^{23} / \text{mol}$ $\ln x = 2.303 \log_{10} x$ calorie = 4.184 J
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1. Completely explain the signal mechanism of glucagon binding to its receptor. You may use pictures, but you must explain the pictures using sentences. Be sure to include these relevant components: ligand binding, activation of second messengers, amplification of signal, measurable cellular response, turning off the signal, getting ready for a new signal.

2. Explain the biosignalling mechanism that you presented in class. It is ok to use pictures, but you must explain the pictures using sentences. Be sure to include these relevant components: ligand binding, activation of second messengers, amplification of signal, measurable cellular response, turning off the signal, getting ready for a new signal.

4. The  $\text{K}^+/\text{Na}^+$  ATPase is a primary active transporter. About 25% of a human's resting energy is used for these transporters. Hydrolysis of ATP releases approximately 30kJ of energy. How many ATP are required to move 3 sodium ions out of a cell and 2 potassium ions inside a cell. The concentration of Na inside the cell is 15mM, the concentration of Na+ outside is 120mM. The concentration of K+ inside the cell is 130mM, the concentration of K+ outside the cell is 9mM. The cell potential is 55 mV (inside is negative).

5. How much more glucose can be accumulated in an intestinal cell via the secondary active transporter that symports Na+ ions and glucose molecules? Use these concentrations for Na+: inside= 5 mM, outside 110mM. The cell potential is 70mV (inside is negative). Report the ratio of glucose(inside) to glucose(outside).

6. When the free energy change for a molecule to cross a cell membrane is positive (+ $\Delta G$ ), which type of transport mechanism is required? Describe this type of transport.

7. Describe what you have learned about COVID-19, the disease caused by infection by SARS-CoV2. (Severe Acute Respiratory Syndrome Coronavirus 2)

8. Complete the following table:

Signal	Type of receptor	Are there adaptor proteins?	Are there second messengers?	Net result of the signal (outcome)
Epinephrine( Beta andrenergic)				
Light				
Insulin *				
Insulin *				
Epidermal Growth Factor				
Tumor Necrosis Factor*				
Tumor Necrosis Factor*				
Glucocorticoid (cortisol)				

\* There were two presentations on some topics; each presentation was focused on a different outcome.

9. Briefly describe each of these types of receptors and give an example of each type of signalling

1. GCPR
2. Tyrosine kinase
3. TNF
4. Steroid

10. Describe the differences between channels and transporters.