

A&P Exam 2 Study Guide

1. Energy currency of the cell (31-32)
 - a. What is the high energy form of energy currency of the cell?
 - i. **ATP Adenosine Triphosphate**
 - b. What is formed when energy is used?
 - i. **ADP Adenosine Diphosphate and Phosphate**
 - c. What is the low energy form?
 - i. **ADP**
2. Mr. Potato head needs to lose or gain weight, explain how he could do this by sitting in water. (35-37)
 - a. **Osmosis. If he has more salts/sugars in his body (hypertonic) then in the water he is sitting in (hypotonic), then he will gain water (weight). If on the other hand he has less salt/sugars in his body (hypotonic) then in the water (hypertonic), then the water will be pulled out of his body into the water solution.**
3. Name and clearly define the process involved in the question above. (35)
 - a. **Osmosis – The diffusion of water across a semipermeable membrane. Osmosis is the diffusion of water, so it is the movement of water from an area of high water concentration to an area of low water concentration. Other particles in water (salts, sugars, etc.) in the water reduce the concentration of the water. Therefore water will move across the membrane from areas with low percentages of salts/sugars(hypotonic) to solutions with high percentages of salts/sugars(hypertonic).**
4. Define / contrast: (35)
 - a. **Hypotonic: Low salt/sugars – High water concentration. Water moves from hypo to hyper.**
 - b. **Isotonic: Equal salt/sugar concentration on each side of the membrane**
 - c. **Hypertonic: High salt/sugars – Low water concentration. Water moves to hyper from hypo.**
5. Diffusion. (33)
 - a. What is diffusion?
 - i. **A movement of molecules from an area of high concentration to low concentration due to the random movement of molecules.**
 - ii. **Diffusion does not require energy**
 - iii. **All molecules in liquids and gasses have rotational spin.**
 - b. Give three factors that affect the rate of diffusion.
 - i. **Concentration gradient: The difference in concentration between the inside of the cell and the outside of the cell. The higher the difference (concentration gradient), the faster the diffusion.**
 - ii. **Molecular Size: The larger the molecule the slower the diffusion.**
 - iii. **Temperature: The higher the temperature the faster molecules move and diffuse.**

- iv. Surface area of the cell: The greater the overall surface area, the faster the rate of diffusion.
 - v. Distance: The farther the molecules have to move the longer it will take to diffuse.
6. Define/Contrast. (34 & 37)
- a. Solubility diffusion
 - i. Things that are soluble in the membrane naturally diffuse through it (fat soluble).
 - ii. i.e. steroid hormones, anesthetics, aspirin, O₂, CO₂
 - iii. H₂O is considered solubility diffusion but uses a protein (aquaporins) to go through the membrane
 - b. Pore diffusion
 - i. Protein pores which allow ions to cross the membrane
 - ii. Most only allow a specific ion to pass through
 - iii. They can be opened or closed, thus named ion gates.
 - iv. I.e. sodium gates, potassium gates
 - c. Facilitated diffusion
 - i. Protein carriers that carry molecules across the cell membrane by diffusion.
 - ii. The rate of diffusion can be limited by the number of protein carriers.
 - iii. I.e. glucose transport into red blood cells, liver, fat, or muscle tissue.
 - iv. Co-transport – moves two types of molecules in or out at the same time. I.e. sodium and chloride transport into same cell.
 - v. Counter Transport – Moves one molecule out while moving another in. I.e sodium potassium pump
 - d. Active Transport
 - i. Uses energy to move chemicals across the membrane against the concentration gradient.
 - ii. Co-transport – moves two types of molecules in or out at the same time. I.e. sodium and chloride transport into same cell.
 - iii. Counter Transport – Moves one molecule out while moving another in. I.e sodium potassium pump
7. Membrane (39).
- a. What are two functions of proteins in the membrane?
 - i. Allow molecules in/out of the cell in a controlled or managed fashion.
 - ii. Act as receptor sites for hormones or neurotransmitters (G-proteins)
 - b. What is membrane potential?
 - i. The charge (voltage difference) across the membrane of the cell, created by the distribution of ions inside and outside the cell and is always reported as the charge inside the cell relative to the outside of the cell

- ii. More positive ions inside the cell than outside, the charge would be positive.
 - iii. More negative ions inside the cell than outside the cell the charge would be negative.
 - c. How do changes in membrane potential affect the membrane proteins?
 - i. If there are more positive ions outside the cell, then the membrane potential will be a negative charge.
 - ii. If there are more negative ions outside the cell, then the membrane potential will be a positive charge.
 - iii. The charge of the membrane may change the shape of some membrane proteins causing them to either open or close.
- 8. Identify the cell organelles on a diagram and give their functions. (30)
- 9. Cells. (29)
 - a. Why have the body made of cells?
 - i. Different cells perform different functions. Each cell can perform its own chemical reactions, manage its own environment independently.
 - b. Why are cells so small?
 - i. The surface area to volume ratio is higher the smaller the cell. Thus a small cell can manage its environment better.
 - c. Why do most cells have organelles?
 - i. Same reasons as why have cells. Each organelle can control its environment and manage the reactions inside itself.
- 10. Draw a section of a cell membrane and label all the important parts. (33)
- 11. Draw a sample diagrams of the following. Be sure to define all symbols you use. (40)
 - a. DNA
 - b. m-RNA
 - c. t-RNA
- 12. Indicate how nitrogenous bases pair up on: (40-41)
 - a. DNA – DNA
 - i. A-T : Adenine \leftrightarrow Thymine
 - ii. G-C : Guanine \leftrightarrow Cytosine
 - b. DNA – m-RNA
 - i. G-C & C-G: Guanine \leftrightarrow Cytosine
 - ii. A-U : Adenine \rightarrow Uracil
 - iii. T-A : Thymine \rightarrow Adenine
 - c. m-RNA – t-RNA
 - i. G-C & C-G: Guanine \leftrightarrow Cytosine and vice versa
 - ii. A-U: Adenine \leftrightarrow Uracil
- 13. Explain protein synthesis from DNA using and defining the following terms: Translation, Transcription, and Ribosome. (42)
 - a. First the DNA is replicated into m-RNA. This process is called transcription, occurs inside the nucleus and is performed by separating the double helix DNA for the section that needs to be transcribed so that a small section of m-RNA can be created from it.
 - b. The m-RNA is then transferred outside the nucleus to the cytoplasm

- c. The Ribosome locks onto one end of the m-RNA molecule
 - d. The ribosome then reads three base sequences at a time (codon) which links to the proper anticodon on the t-RNA. Each t-RNA has a specific amino acid attached to it. Therefore the proper amino acid is attached in the proper sequence of amino acids for this protein.
 - e. Once the ribosome has moved all the way down the m-RNA molecule all the amino acids have been put in place to make the protein.
14. Explain what happens in the steps of mitosis and meiosis. In mitosis what occurs in the G1, S, and G2 phases. How are cyclins and kinases involved in regulation of the cell cycle. (44-48 & 52-55)
- a. Mitosis:
 - i. Normal cell division, creates two diploid cells. For growth or repair.
 - ii. Interphase – The phase between cell division. Most cells are in this phase for the majority of their lives. Can be divided into three sub phases:
 - 1. G1 Phase – (First gap phase), Routine metabolism. Carries out its normal functions whatever they are for that particular cell
 - 2. S Phase – (Synthesis phase). DNA is replicated.
 - 3. G2 Phase – (Second gap phase), cell prepares for division.
 - iii. Prophase – (Before phase) chromosomes super-coil and become visible, the nuclear membrane breaks down
 - iv. Metaphase – (Middle phase) chromosomes align across the center of the cell singly, homologous chromosomes are not paired.
 - v. Anaphase – (After phase) chromatids separate and move to the poles of the cell
 - vi. Telophase – (End phase) cells separate (cytokinesis) chromosomes unsuper-coil, nuclear membrane reforms
 - b. Meiosis:
 - i. For reproduction, creates four sex cells, haploids.
 - ii. Interphase – The phase between cell division. Similar to in mitosis. DNA is replicated in same fashion as in mitosis.
 - iii. Prophase I – chromosomes super-coil and become visible, nuclear membrane breaks down, Crossover occurs – creating new combinations of chromosomes.
 - iv. Metaphase I – chromosomes align across the center of the cell with homologous chromosomes paired, independent assortment occurs = maternal and paternal chromosomes line up and separate independently (chromosomes have a mix of paternal and maternal genes on them).
 - v. Anaphase I – Homologous pairs separate and move to the poles of the cell
 - vi. Telophase I – cells separate – cytokinesis, form two cells each with 23 chromosomes.

- vii. Prophase II – Usually does not occur because the chromosomes do not unsuper-coil in telophase I
- viii. Metaphase II – chromosomes align across the center of the cell singly, homologous chromosomes are not paired since they are now in two separate cells.
- ix. Anaphase II – chromatids separate and move to the poles of the cells
- x. Telophase II – cells separate – cytokinesis, forming two cells, chromosomes unsuper-coil, nuclear membrane forms. Cells have 23 chromosomes.
- xi. Process forms four different haploid cells. Sperm cells in males, Ootid in females, only one ootid in the female survives.

15. List and define the characteristics of tumors. (49-50)

- a. Hyperplasia – uncontrolled cell division
- b. Anaplasia – Cells do not specialize the way they should, usually resemble undifferentiated cells.
- c. Benign – a tumor that is not metastatic
- d. Malignant – a tumor that is metastatic
- e. Metastatic – when cells break free from the original tumor and move to other parts of the body where they start new tumors. Metastatic tumors = cancer.

16. Why do tumors occur? (49)

- a. Caused by mutations in the DNA of cells usually caused by one of the following:
 - i. Radioactive chemicals
 - ii. Ultraviolet radiation
 - iii. Chemicals – carcinogen (a chemical that causes tumors)
 - iv. Some Viruses
 - v. Improper gene regulation

17. Respiration. (57)

- a. How is anaerobic respiration different then aerobic respiration?
 - i. Anaerobic:
 - 1. Respiration without O₂
 - 2. Produces 2 ATP
 - 3. Produces lactic acid
 - 4. The O₂ and energy required to remove the lactic acid is known as oxygen debt
 - 5. Most of the lactic acid that is produced is removed from the blood by the liver and converted back to glucose
 - ii. Aerobic:
 - 1. Respiration with O₂
 - 2. Produces 36 ATP
 - 3. Normal respiration
 - 4. Does not produce Oxygen debt or lactic acid
- b. What accumulates in cells during anaerobic respiration?
 - i. Lactic acid

- c. What is O₂ debt?
i. The O₂ and energy needed to remove built up lactic acid is referred to as oxygen debt
18. What toxic waste will be formed if your body is burning amino acids and what will the liver transform this waste into?
a. Ammonia is formed, which is then transferred to the liver where it is converted into urea.
19. List and define the four major tissue types found in the body. (60)
a. Epithelial tissue – Tissue that lines the outside of the body (skin, glands, linings of organs/cavities that receive input from outside body)
b. Connective tissue – Tissue that holds the body together (
c. Muscle tissue – Contractile tissue (voluntary, smooth, cardiac)
d. Nervous tissue – Tissue that can carry nerve signals (nerves, brain cells)
20. What determines a person's skin color? (64)
a. The amount of melanin produced by the melanocyte cells in a person.
21. Define and compare the parts of the integument.
a. Epidermis
i. Outer most layer of skin
ii. Lacks blood vessels
iii. Stratum corneum
iv. Filled with keratin
v. Cells are hard and dead
vi. Prevent water loss
b. Dermis
i. Has blood vessels
ii. Mostly connective tissue
iii. Has macrophages and fibroblasts
c. Subcutaneous layer
i. Layer of mostly fat under the dermis
d. Do men or women have a thicker subcutaneous layer and why?
i. Usually thicker in women, more insulation to keep the body in a more controlled temperature environment.
22. Compare and contrast the layers of the epidermis. (65)
a. Stratum basale – single layer of cuboidal to columnar shaped cells at the base of the epidermis. Where the melanocytes are found.
b. Stratum spinosum – 8-10 layers of polyhedral shaped cells above the stratum basale.
c. Stratum granulosum – 3-5 layers of flattened cells that develop dark staining. Cells are dying as they are filled with keratin
d. Stratum lucidum – 3-5 layers of clear flat cells that contain droplets of eleidin which is transformed into keratin
e. Stratum corneum – 25-30 layers of flat dead cells filled with keratin
23. Compare and contrast the layers of the dermis. (67)
a. Papillary region: loose connective tissue
b. Reticular layer – has the base of the hair follicles in it as well as collagen fibers and nerves.

24. Explain how hair grows. (68)
- Hair grows from the base as new cells are added**
 - The hair on the outside is dead keratin filled cells**
 - Color is determined by genes**
 - Muscles in the follicle can move the hair (i.e. goose bumps)**
25. Compare and contrast the following glands: (69)
- Holocrine – **Produce their secretions when whole cells break off and break open dumping their contents. I.e. sebaceous glands**
 - Merocrine – **Produce their secretions by moving material out of the cells by osmosis or exocytosis. I.e. salivary glands, eccrine glands**
 - Apocrine – **Produce their secretions by having a portion of the cell break off with the secretions. I.e. mammary glands and apocrine sweat glands.**
26. Compare and contrast the following glands: (69-70)
- Sebaceous – **Glands in skin associated with hair follicles and produce an oily secretion called sebum which helps keep the skin soft, pliable and water proof.**
 - Apocrine sweat – **Sweat glands located in groin and arm pits. Usually associated with hair follicles, not associated with body cooling, produce secretions in association with stress, produce water, salts, and pheromones**
 - Eccrine sweat – **These glands are all over the body, not associated with hair follicles, primary function is cooling of the body, produce water with a small amount of salt, merocrine glands**
27. List three things that are likely to occur in your body if you are too hot or too cold (71)
- Too hot:
 - Sweating increased**
 - Increased blood flow to skin and body extremities**
 - Reduce metabolism (to produce less heat)**
 - Too cold:
 - No sweating**
 - Blood vessels move away from skin, less blood sent to extremities keep it in core**
 - Increase metabolism (to produce more heat)**
 - Shivering (cause muscles to produce more heat)**