

•Nonpolar region of phospholipid.

Answer: C

•Glycocalyx. Answer: A

•Polar region of phospholipid.

Answer: B

•Peripheral protein. Answer: E

•Integral protein. Answer: D

•Identification "tags" for the cell.

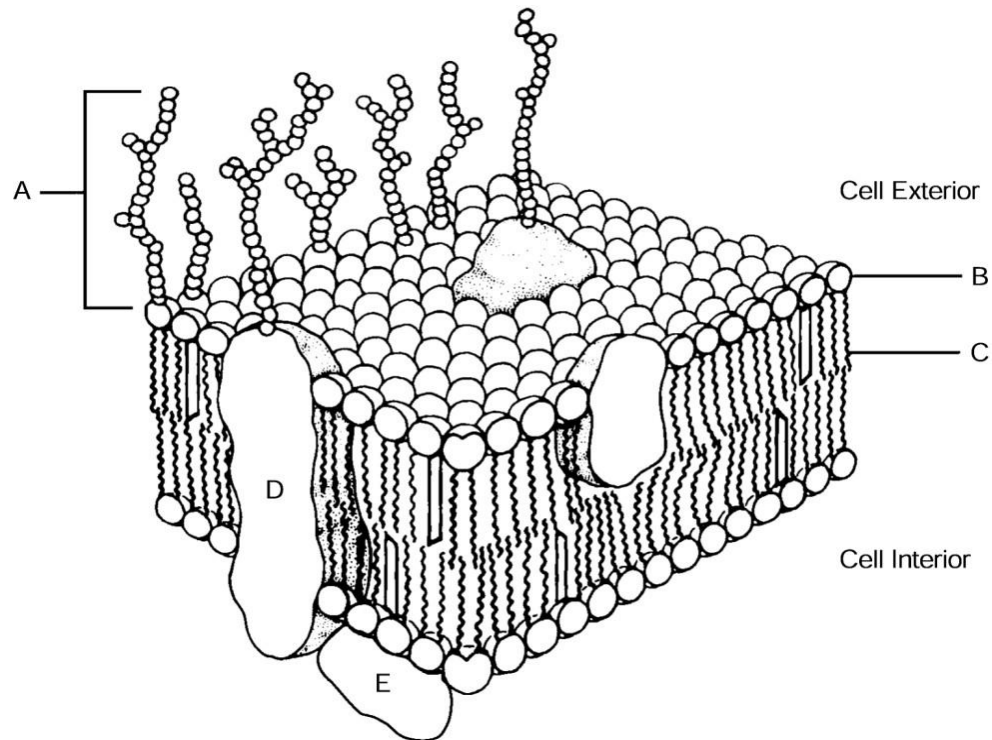
Answer: A

•

•Receptors for signal transducers.

Answer: D

•Hydrophilic portion. Answer: B



17) Forms part of the protein synthesis site in the cytoplasm.

Answer:

18) Act as "interpreter" molecules that recognize specific amino acids and nucleotide base sequences.

Answer:

19) Attaches the correct amino acid to its transfer RNA.

Answer:

20) Provides the energy needed for synthesis reactions.

Answer:

21) Found in the cytoplasm, this structure specifies the exact sequence of amino acids of the protein to be made.

Answer:

22) May be attached to the ER or scattered in the cytoplasm.

Answer:

- A) Synthetase enzymes
- B) Messenger RNA
- C) Transfer RNA
- D) Ribosomal RNA
- E) ATP

17) Forms part of the protein synthesis site in the cytoplasm.

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23) Chromosomes decoil to form chromatin.

Answer:

24) Chromosomal centromeres split and chromosomes migrate to opposite ends of the cell.

Answer:

A) Early prophase

B) Metaphase

C) Late prophase

D) Telophase

E) Anaphase

25) Nuclear membrane and nucleolus disintegrate.

Answer:

26) Chromosomes align on the spindle equator.

Answer:

27) Centrioles move to opposite ends of the cell.

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28) Plays a role in synthesis of steroid-based hormones and proteins.

Answer:

A) Ribosomes

B) Microtubules

C) Nucleoli

D) Nucleus

E) Endoplasmic reticulum

29) The actual site of protein synthesis.

Answer:

30) Hollow cytoskeletal elements that act as organizers for the cytoskeleton.

Answer:

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# **True/False Questions**

1) Each daughter cell resulting from mitotic cell division has exactly as many chromosomes as the parent cell.

Answer:

2) Apoptosis is programmed cell suicide, but cancer cells fail to undergo apoptosis.

Answer:

3) The spindle is formed by the migration of the chromatin.

Answer:

4) Final preparation for cell division is made during the cell life cycle subphase called G2.

Answer:

5) Chromatin consists of DNA and RNA.

Answer:

6) In osmosis, movement of water occurs toward the solution with the lower solute concentration.

Answer:

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7) The genetic information is coded in DNA by the regular alternation of sugar and phosphate molecules.

Answer:

8) A process by which large particles may be taken into the cell for protection of the body or for disposing of old or dead cells is called phagocytosis.

Answer:

9) The orderly sequence of the phases of mitosis is prophase, metaphase, anaphase, and telophase.

Answer:

10) Diffusion is always from areas of greater to areas of lesser concentration.

Answer:

11) Facilitated diffusion always requires a carrier protein.

Answer:

12) Pressure caused by gravity is necessary for any filtration pressure to occur in the body.

Answer:

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13) DNA transcription is another word for DNA replication.

Answer:

14) The glycocalyx is often referred to as the "cell coat," which is somewhat fuzzy and sticky with numerous cholesterol chains sticking out from the surface of the cell membrane.

Answer:

15) In their resting state, all body cells exhibit a resting membrane potential ranging from -50 to about +50 millivolts.

Answer:

16) Microfilaments are thin strands of the contractile protein myosin.

Answer:

17) Interstitial fluid represents one type of extracellular material.

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18) Hyperplasia generally means that an organ will increase in size due to the excessive formation of extracellular fluids.

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19) A chemical that inhibits DNA synthesis has yet to be found in aging cells.

Answer:

20) The cell (plasma) membrane normally contains substantial amounts of cholesterol.

Answer:

21) Aquaporins are believed to be present in red blood cells, kidney tubules, and very few other cells in the body.

Answer:

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## **Aquaporins: Water Channels**

Water crosses cell membranes by two routes: by diffusion through the lipid bilayer and through water channels called aquaporins.

Major Sites of Expression	Comments	
<b>Aquaporin-0</b>	Eye: lens fiber cells	Fluid balance within the lens
	Red blood cells	Osmotic protection
	Kidney: proximal tubule	Concentration of urine
<b>Aquaporin-1</b>	Eye: ciliary epithelium	Production of aqueous humor
	Brain: choroid plexus	Production of cerebrospinal fluid
	Lung: alveolar epithelial cells	Alveolar hydration state
<b>Aquaporin-2</b>	Kidney: collecting ducts	Mediates antidiuretic hormone activity
<b>Aquaporin-3 *</b>	Kidney: collecting ducts	Reabsorption of water into blood
	Trachea: epithelial cells	Secretion of water into trachea
	Kidney: collecting ducts	Reabsorption of water
<b>Aquaporin-4</b>	Brain: ependymal cells	CSF fluid balance
	Brain: hypothalamus	Osmosensing function?
	Lung: bronchial epithelium	Bronchial fluid secretion
<b>Aquaporin-5</b>	Salivary glands	Production of saliva
	Lacrimal glands	Production of tears
<b>Aquaporin-6</b>	Kidney	Very low water permeability; function?
	Fat cells	Transports glycerol out of adipocytes
<b>Aquaporin-7 *</b>	Testis and sperm	
<b>Aquaporin-8</b>	Testis, pancreas, liver, others	
<b>Aquaporin-9 *</b>	Leukocytes	

23) Only one cell type in the human body has a flagellum.

Answer:

24) Microtubules are hollow tubes made of subunits of the protein tubulin.

Answer:

25) Telomeres are the regions of chromosomes that code for the protein ubiquitin.

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# **Multiple-Choice Questions**

1) Which of the following is true regarding the generation of a membrane potential?

- A) Both potassium and sodium ions can "leak" through the cell membrane due to diffusion.
- B) In the polarized state, sodium and potassium ion concentrations are in static equilibrium.
- C) The maintenance of the potential is based exclusively on diffusion processes.
- D) When the sodium-potassium pump is activated, potassium is pumped into the cell twice as fast as the sodium is pumped out, thus causing the membrane potential.

2) Transcytosis is \_\_\_\_\_.

- A) combining an endosome with a lysosome and degrading or releasing the contents
- B) transporting an endosome from one side of a cell to the other and releasing the contents by exocytosis
- C) recycling the contents of the endosome back to the surface of the cell
- D) storing the contents of the endosome



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Answer: B

3) Calcium ions are stored (in the cell) \_\_\_\_\_.

- A) in the smooth ER
- B) in the rough ER
- C) in both smooth and rough ER
- D) in the cytoplasm

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4) The RNA responsible for bringing the amino acids to the "factory" site for protein formation is the \_\_\_\_\_.

- A) rRNA
- B) mRNA
- C) tRNA
- D) ssRNA

5) A red blood cell placed in pure water would \_\_\_\_\_.

- A) shrink
- B) swell initially, then shrink as equilibrium is reached
- C) neither shrink nor swell
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- 6) The plasma membrane (cell membrane) is \_\_\_\_\_.
- A) a single-layered membrane that surrounds the nucleus of the cell
  - B) a double layer of protein enclosing the plasma
  - C) the phospholipid bilayer surrounding the cell
  - D) a membrane composed of tiny shelves or cristae

- 7) Which of these is *not* a function of the plasma membrane?
- A) It is selectively permeable.
  - B) It prevents potassium ions from leaking out and sodium ions from crossing into the cell.
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8) Which structures are fingerlike projections that greatly increase the absorbing surface of cells?

- A) stereocilia
- B) microvilli
- C) cilia
- D) flagella

9) Which of the following statements is correct regarding diffusion?

- A) The rate of diffusion is independent of temperature.
- B) The greater the concentration of gradient, the faster the rate of diffusion.
- C) Molecular weight of a substance does not affect the rate of diffusion.
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10) Cell junctions that promote the coordinated activity of cells by physically binding them together into a cell community include all of the following *except* \_\_\_\_\_.

- A) gap junctions
- B) desmosomes
- C) peroxisomes
- D) tight junctions

11) If cells are placed in a hypertonic solution containing a solute to which the membrane is impermeable, what could happen?

- A) The cells will swell and ultimately burst.
- B) The cells will lose water and shrink.
- C) The cells will shrink at first, but will later reach equilibrium with the surrounding solution and return to their original condition.
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12) Which of the following is *not* a subcellular structure?

- A) intercellular material
- B) membranes
- C) cytoplasm
- D) organelles

13) Once solid material is phagocytized and taken into a vacuole, which of the following statements best describes what happens?

- A) A ribosome enters the vacuole and uses the amino acids in the "invader" to form new protein.
- B) A lysosome combines with the vacuole and digests the enclosed solid material.
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- B) specific tRNAs
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- B) nucleus replication
- C) to create diversity in genetic potential
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23) Which of the following is true regarding cells in humans?

- A) Organelles are independent life forms.
- B) Maximum cell diameter is limited to 2 micrometers.
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- A) are exclusively hydrophilic molecules
- B) contain polar tails and nonpolar head groups
- C) are both hydrophilic and hydrophobic in nature
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25) Passive membrane transport processes include \_\_\_\_\_.

- A) movement of a substance down its concentration gradient
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- C) consumption of ATP
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- A) are always the same shape
- B) are single-membrane structures involved in the breakdown of ATP
- C) contain some of the code necessary for their own duplication
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28) Ribosomes, endoplasmic reticulum, and the Golgi apparatus functionally act in sequence to synthesize and modify proteins for secretory use (export) only, never for use by the cell. This statement is \_\_\_\_\_.

- A) false; proteins thus manufactured are for use inside the cell only
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- C) false; lipids, not proteins, are synthesized this way
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32) In the maintenance of the cell resting membrane potential \_\_\_\_\_.

- A) extracellular sodium levels are high
- B) cells are more permeable to  $\text{Na}^+$  than  $\text{K}^+$
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Answer: A

33) Which of the following is a concept of the cell theory?

- A) Simple cells can arise spontaneously from rotting vegetation.
- B) A cell is the basic structural and functional unit of living organisms.
- C) The subcellular organelle is the basic unit of life.
- D) Only higher organisms are composed of cells.

34) Cells are composed mainly of \_\_\_\_\_.

- A) carbon, potassium, sodium, nitrogen
- B) carbon, sodium, nitrogen, calcium
- C) calcium, oxygen, sodium, potassium
- D) carbon, hydrogen, nitrogen, oxygen



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35) Which of the following is a principle of the fluid mosaic model of cell membrane structure?

- A) Phospholipids form a bilayer that is largely impermeable to water-soluble molecules.
- B) Phospholipids consist of a polar head and a nonpolar tail made of three fatty acid chains.
- C) The lipid bilayer is a solid at body temperature, thus protecting the cell.
- D) All proteins associated with the cell membrane are contained in a fluid layer on the outside of the cell.

36) Which of the following statements is most correct regarding the intracellular chemical signals known as "second messengers"?

- A) Second messengers act through receptors called K-proteins.
- B) Second messengers usually inactivate protein kinase enzymes.
- C) Cyclic AMP and calcium are second messengers.
- D) Second messengers usually act to remove nitric oxide (NO) from the cell.

35) Which of the following is a principle of the fluid mosaic model of cell membrane structure?

- A) Phospholipids form a bilayer that is largely impermeable to water-soluble molecules.
- B) Phospholipids consist of a polar head and a nonpolar tail made of three fatty acid chains.
- C) The lipid bilayer is a solid at body temperature, thus protecting the cell.
- D) All proteins associated with the cell membrane are contained in a fluid layer on the outside of the cell.

Answer: A

36) Which of the following statements is most correct regarding the intracellular chemical signals known as "second messengers"?

- A) Second messengers act through receptors called K-proteins.
- B) Second messengers usually inactivate protein kinase enzymes.
- C) Cyclic AMP and calcium are second messengers.
- D) Second messengers usually act to remove nitric oxide (NO) from the cell.

Answer: C

37) The main component of the cytosol is \_\_\_\_\_.

- A) proteins
- B) sugars
- C) salts
- D) water

38) Lysosomes \_\_\_\_\_.

- A) are used mainly for the cell to "commit suicide"
- B) contain acid hydrolases that are potentially dangerous to the cell
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- D) are the major site of protein synthesis

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Answer: B

39) The endomembrane system is \_\_\_\_\_.

- A) a system by which cells are riveted together by desmosomes
- B) an interactive system of organelles whose membranes are physically or functionally connected
- C) the process by which bacteria took up residence in ancient cells
- D) a system of hydrophilic lipid monolayers that surround cell organelles

40) The functions of centrioles include \_\_\_\_\_.

- A) organizing the mitotic spindle in cell division
- B) providing a whiplike beating motion to move substances along cell surfaces
- C) serving as the site for ribosomal RNA synthesis
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Answer: A

41) A gene can best be defined as \_\_\_\_\_.

- A) a three-base triplet that specifies a particular amino acid
- B) noncoding segments of DNA up to 100,000 nucleotides long
- C) a segment of DNA that carries the instructions for one polypeptide chain
- D) an RNA messenger that codes for a particular polypeptide



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Answer: C

42) Extracellular matrix is \_\_\_\_\_.

- A) composed of strands of actin protein
- B) the most abundant extracellular material
- C) a type of impermeable cell junction found in epithelia
- D) not present in connective tissue

43) Crenation is an example of \_\_\_\_\_.

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- B) blood cells in a hypotonic solution
- C) blood cells in a hypertonic solution
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Answer: C

44) Some hormones enter cells via \_\_\_\_\_.

- A) exocytosis
- B) endocytosis
- C) pinocytosis
- D) receptor-mediated endocytosis

45) If a tRNA had an AGC anticodon, it could attach to a(n) \_\_\_\_\_ mRNA codon.

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Answer: B

# **Fill-in-the-Blank/Short Answer Questions**

1) The RNA that has an anticodon and attaches to a specific amino acid is \_\_\_\_\_ RNA.

Answer:

2) Water may move through membrane pores constructed by transmembrane proteins called \_\_\_\_\_.

Answer:

3) \_\_\_\_\_ is the division of the cytoplasm.

Answer:

4) The metabolic or growth phase of a cell life cycle is called \_\_\_\_\_.

Answer:

5) In order for the DNA molecule to get "short and fat" to become a chromosome, it must first wrap around small molecules called \_\_\_\_\_.

Answer:

1) The RNA that has an anticodon and attaches to a specific amino acid is \_\_\_\_\_ RNA.

Answer: transfer

2) Water may move through membrane pores constructed by transmembrane proteins called \_\_\_\_\_.

Answer: aquaporins

3) \_\_\_\_\_ is the division of the cytoplasm.

Answer: Cytokinesis

4) The metabolic or growth phase of a cell life cycle is called \_\_\_\_\_.

Answer: interphase

5) In order for the DNA molecule to get "short and fat" to become a chromosome, it must first wrap around small molecules called \_\_\_\_\_.

Answer: histones



6) \_\_\_\_\_ are hollow tubes made of spherical protein subunits called tubulins.

Answer:

7) Aerobic cellular respiration occurs in the \_\_\_\_\_.

Answer:

8) Two very important second messengers used in the G protein-linked receptor mechanism are cyclic AMP and \_\_\_\_\_.

Answer:

9) The most common extracellular ion is \_\_\_\_\_.

Answer:

10) The process of discharging particles from inside a cell to the outside is called \_\_\_\_\_.

Answer:

11) A red blood cell would swell if its surrounding solution were \_\_\_\_\_.

Answer:

6) \_\_\_\_\_ are hollow tubes made of spherical protein subunits called tubulins.

Answer: Microtubules

7) Aerobic cellular respiration occurs in the \_\_\_\_\_.

Answer: mitochondria

8) Two very important second messengers used in the G protein-linked receptor mechanism are cyclic AMP and \_\_\_\_\_.

Answer: ionic calcium

9) The most common extracellular ion is \_\_\_\_\_.

Answer: sodium

10) The process of discharging particles from inside a cell to the outside is called \_\_\_\_\_.

Answer: exocytosis

11) A red blood cell would swell if its surrounding solution were \_\_\_\_\_.

Answer: hypotonic

12) A \_\_\_\_\_ is a channel between cells.

Answer:

13) Describe two important functions of the Golgi apparatus.

Answer:..

14) Why can we say that a cell without a nucleus will ultimately die?

Answer:

15) Are Brownian motion, diffusion, and osmosis seen only in living tissue?

Answer:..

16) What forces maintain a steady state "resting" membrane potential?

Answer:

12) A \_\_\_\_\_ is a channel between cells.

Answer: connexon

13) Describe two important functions of the Golgi apparatus.

Answer: To modify, sort, and package proteins.

14) Why can we say that a cell without a nucleus will ultimately die?

Answer: Without a nucleus, a cell cannot make proteins, nor can it replace any enzymes or other cell structures (which are continuously recycled).

Additionally, such a cell could not replicate.

15) Are Brownian motion, diffusion, and osmosis seen only in living tissue?

Answer: No. Since they are passive processes that do not require energy, they can occur in the absence of any cellular processes.

16) What forces maintain a steady state "resting" membrane potential?

Answer: Both diffusion and active transport mechanisms operate within the cell membrane to maintain a resting membrane potential.

17) Briefly describe the glycocalyx and its functions.

**Answer:**

18) Explain the term *genetic code*. What does it code for? What are the letters of the code?

**Answer:**

19) Why are free radicals so dangerous to cells, and how are they dealt with by the body?

**Answer:**

17) Briefly describe the glycocalyx and its functions.

**Answer: The glycocalyx is the sticky, carbohydrate-rich area on the cell surface. It helps bind cells together and provides a highly specific biological marker by which cells can recognize each other.**

18) Explain the term *genetic code*. What does it code for? What are the letters of the code?

**Answer: The genetic code is the information encoded in the nucleotide base sequence of DNA. A sequence of three bases, called a triplet, specifies amino acid in a protein. The letters of the code are the four nucleotide bases of DNA designated as A, T, C, and G.**

19) Why are free radicals so dangerous to cells, and how are they dealt with by the body?

**Answer: Free radicals are highly reactive chemicals that cause havoc in any cellular environment by reacting with things they should not. Cells with peroxisomes have enzymes specific to reducing free radicals into less reactive chemicals**

20) In all living cells hydrostatic and osmotic pressures exist. Define these pressures and explain how they are used in the concept of tonicity of the cell.

**Answer:**

21) What is the common route of entry for flu viruses into a cell?

**Answer:**

22) Which organelles have their own DNA?

**Answer:**

20) In all living cells hydrostatic and osmotic pressures exist. Define these pressures and explain how they are used in the concept of tonicity of the cell.

**Answer: Hydrostatic pressure is the pressure of water exerted on the cell membrane. Osmotic pressure is created by different concentrations of molecules in a solution separated by the cell membrane. Since these pressures are exerted on the membrane they can be used by the cell to change the shape of the cell, regulate substances entering and exiting the cell, and bring about the polarity of the cell.**

21) What is the common route of entry for flu viruses into a cell?

**Answer: Flu viruses and diphtheria toxins use receptor-mediated endocytosis. The virus can attach to the receptors or to the substances the receptors accept to "hitch a ride" into the cell.**

22) Which organelles have their own DNA?

**Answer: Mitochondria, nucleus, and centrioles**



23) How are the products of free ribosomes different from membrane-bound ribosomes?

**Answer:**

24) How are peroxisomes different from lysosomes?

**Answer:**

25) Briefly name the subphases of interphase and tell what they do.

**Answer:**

23) How are the products of free ribosomes different from membrane-bound ribosomes?

**Answer: Free ribosomes make soluble proteins that function in the cytosol. Membrane-bound ribosomes produce proteins that are to be used on the cell membrane or exported from the cell.**

24) How are peroxisomes different from lysosomes?

**Answer: Some of the peroxisomes are oxidases which use oxygen to detoxify harmful substances. They are very good at neutralizing free radicals. Peroxisomes divide by simply budding. Lysosomes have powerful hydrolytic enzymes that will pretty much destroy anything they come in contact with. They are manufactured by the Golgi apparatus.**

25) Briefly name the subphases of interphase and tell what they do.

**Answer: G1 - growth phase. The cell is metabolically active and the centriole begins to divide at the end of this phase.**

**S - DNA replicates itself. New histones are made and assembled into chromatin.**

**G2 - Enzymes and proteins are synthesized and centriole replication is completed. This is the final phase of interphase**