4. (a). Draw and label the structures of plant and animal cells as seen under high power magnification of light microscope

(b). Compare and contrast the two cells in (a) above.

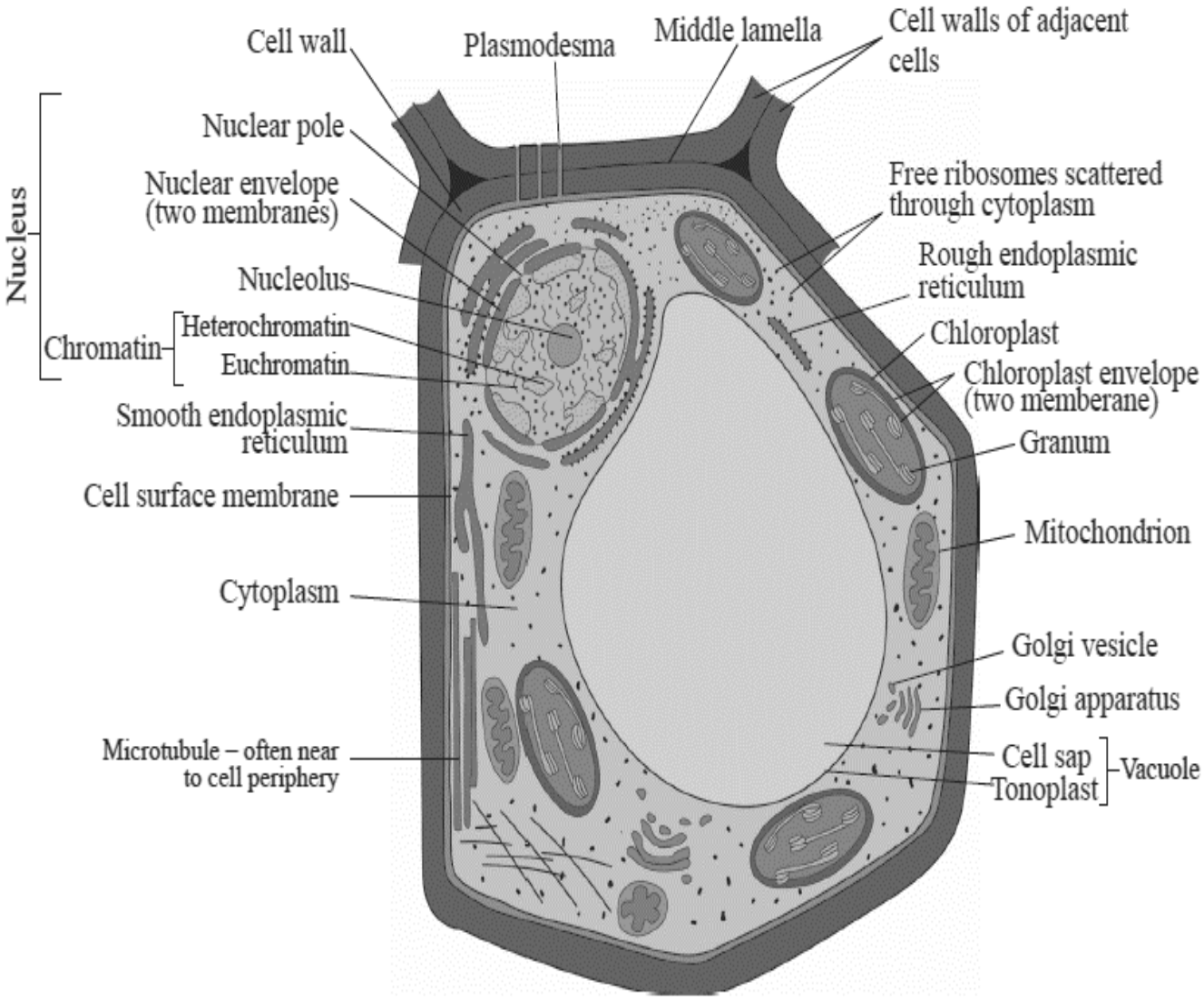

Diagram of plant cell

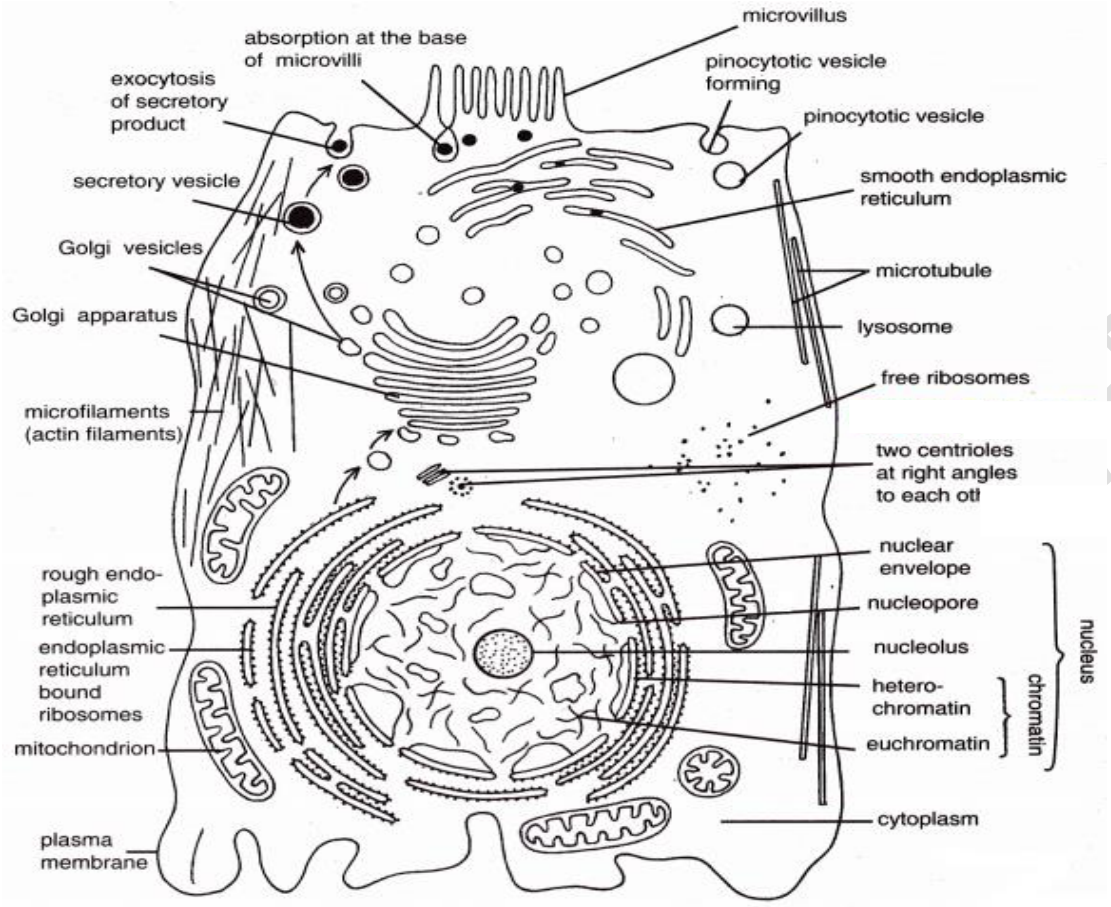

Diagram of animal cell

Similarities:

i. *Both have a cell membrane that regulates the movement of substances in and out of the cell.*

ii. *Both have a nucleus that contains the genetic material of the cell.*

iii. *Both have mitochondria that generate energy for the cell through cellular respiration.*

iv. *Both have ribosomes that synthesize proteins.*

v. *Both use the endoplasmic reticulum and the Golgi apparatus to modify and transport proteins.*

vi. *Both have cytoplasm that contains various organelles and other components of the cell.*

vii. *Both have lysosomes, which contain enzymes that break down waste materials.*

viii. *Both have peroxisomes, which contain enzymes that break down toxic substances.*

ix. *Both can undergo cellular respiration to produce energy.*

x. *Both can reproduce through mitosis.*

Differences:

i. *Plant cells have a cell wall made of cellulose, which animal cells lack.*

ii. *Plant cells have chloroplasts, which contain chlorophyll and carry out photosynthesis to produce food, while animal cells do not have chloroplasts.*

iii. *Plant cells have large central vacuoles that store water and nutrients, while animal cells have smaller, scattered vacuoles.*

iv. *Plant cells have plasmodesmata, small channels that connect adjacent cells, while animal cells do not have such structures.*

v. *Animal cells have centrioles that play a role in cell division, while plant cells do not.*

vi. *Plant cells have a more regular shape than animal cells, which can be more irregular.*

vii. *Plant cells contain amyloplasts, specialized organelles that store starch, while animal cells do not.*

viii. *Animal cells contain glycogen granules, which store energy, while plant cells do not have glycogen.*

ix. *Plant cells are generally larger than animal cells.*

x. *Plant cells can produce and store oils, while animal cells do not have this capability.*

50. Explain the properties of water.

i. ***Universal Solvent****: Water is often referred to as the "universal solvent" because it has the ability to dissolve a wide variety of substances.*

ii. ***High Heat Capacity****: Water has a high heat capacity, which means it can absorb and store a substantial amount of heat energy without a significant increase in temperature. This property helps regulate the Earth's climate and allows living organisms to maintain relatively stable internal temperatures.*

iii. ***High Heat of Vaporization****: Water requires a significant amount of heat energy to change from a liquid to a gas (vapor). This property makes water an effective coolant and is essential for processes like evaporative cooling, which helps regulate temperatures in living organisms.*

iv. ***Cohesion and Adhesion****: Water molecules are cohesive, meaning they are attracted to each other. This property is responsible for the formation of surface tension, which allows some organisms to walk on water. Water is also adhesive, meaning it can adhere to other surfaces, which is essential for processes like capillary action in plants.*

v. ***Density Anomaly****: Unlike most substances, water is less dense as a solid (ice) than as a liquid. This property is due to the formation of a hexagonal lattice structure in ice, which spaces the water molecules farther apart. It is crucial for aquatic ecosystems, as it prevents bodies of water from freezing solid and allows life to survive in the lower layers.*

vi. ***High Dielectric Constant****: Water has a high dielectric constant, which makes it an excellent solvent for ions and polar molecules. It is essential for processes like ionic dissociation and the functioning of biological molecules in solution.*

vii. ***Transparency****: Water is transparent to visible light, which is important for aquatic life as it allows sunlight to penetrate the water, facilitating photosynthesis in plants and providing energy for various ecosystems.*

viii. ***Surface Tension****: Water exhibits a strong surface tension due to the cohesive forces between its molecules. This property allows insects, like water striders, to walk on the water's surface and is also involved in the formation of droplets.*

ix. ***Versatility****: Water can exist in three states (solid, liquid, and gas) at temperatures commonly found on Earth's surface. This versatility allows water to participate in a wide range of physical and chemical processes that are essential for life.*

x. ***Hydrogen Bonding****: Water molecules can form hydrogen bonds with each other and with other polar molecules. These hydrogen bonds are responsible*

for many of water's unique properties, such as its high heat capacity, high heat of vaporization, and surface tension.

51. Why is mitochondria said to be a cell within a cell

i. *Both mitochondria and chloroplasts have a double membrane structure as cell*

ii. *Both contain their own circular DNA, similar to the DNA found in prokaryotic bacteria. This circular DNA is in contrast to the linear DNA found in the host cell's nucleus, reinforcing their prokaryotic heritage.*

iii. *Both contain ribosomes similar to prokaryotic ribosomes than those in the cytoplasm of eukaryotic cells. This similarity suggests that the organelles inherited their ribosomes from their prokaryotic ancestors.*

iv. *Mitochondria and chloroplasts have the capacity to replicate independently of the cell's nucleus. This self-replication is reminiscent of the binary fission process seen in prokaryotic cells, where one cell divides into two. This autonomy in replication is a key characteristic of free-living prokaryotes.*

v. *Both have fluid like material matrix for mitochondria and stroma for chloroplast where different chemical reaction take place as cytoplasm in cell.*

vi. *From endosymbiotic theory proposes that mitochondria were once free-living alpha-proteobacteria that were engulfed by a eukaryotic host cell. Similarly, chloroplasts are believed to have evolved from endosymbiotic cyanobacteria. These engulfed prokaryotes eventually established a mutually beneficial relationship with the host cell, becoming integrated as organelles while retaining their prokaryotic traits*