

**Alberta Biology 20-30 Sample CAB Questions**

1. The sun is the source of energy for the Biosphere. Solar energy is either stored or radiated back into space. The process by which living organisms store energy, without the help of sunlight, is known as

- A. decomposition
- B. chemosynthesis
- C. respiration
- D. transpiration

ANS: B

Chemosynthesis is the process by which living organisms store energy, without the help of sunlight.

PTS: 1

DIF: Easy

OBJ: Section 1.1

LOC: 20–A1.1k

TOP: Biosphere

KEY: Energy flow through biosphere

MSC: Knowledge

2. Various living and non-living processes occur in the biosphere that result in the release of energy.

Energy is not released during

- A. fossil fuel combustion
- B. contraction of muscle
- C. burning of firewood
- D. photosynthesis

ANS: D

Solar energy is absorbed during the process of photosynthesis.

PTS: 1

DIF: Easy

OBJ: Section 1.1

LOC: 20–A1.1k

TOP: Biosphere

KEY: Energy flow through biosphere

MSC: Knowledge

3. Fossil fuel combustion affects the balance of the biosphere. Which of the following events does not occur during fossil fuel combustion?

- A. Carbon reacts with oxygen
- B. Hydrogen reacts with oxygen
- C. CO<sub>2</sub> gas is added to the atmosphere
- D. Water formation does not occur

ANS: D

During fossil fuel combustion, carbon and hydrogen react with oxygen and form carbon dioxide and water.

PTS: 1

DIF: Easy

OBJ: Section 1.1

LOC: 20–A1.2k

TOP: Biosphere

KEY: Biological Energy in biosphere

MSC: Knowledge

4. Use the following information to answer the next question.

Living organisms that can synthesize their own food, using energy and raw materials, are known as producers. These organisms are also known as autotrophs. Autotrophs usually include photosynthetic plants.

Photosynthetic producers are absent in

- A. ponds
- B. forests
- C. Sahara Desert
- D. deep sea vents

ANS: D

Sunlight never reaches the deep sea vents. The organisms thus have to depend on chemicals rather than the solar energy. Thus photosynthetic producers are absent in deep sea vents.

PTS: 1

DIF: Easy

OBJ: Section 1.1

LOC: 20–A1.2k

TOP: Biosphere

KEY: Biological Energy in biosphere

MSC: Knowledge

5. Use the information given below to answer the next two questions.

The trophic level describes the position of an organism in a food chain. The word ‘trophic’ is derived from a Greek word ‘trophe’ which means food.

What is the trophic level obtained by an herbivore in the food chain that starts with the producer?

- A. First
- B. Second

C. Third

D. Final

ANS: B

The producer will be at the first trophic level and it will be followed by the herbivore at the second trophic level.

PTS: 1

DIF: Easy

OBJ: Section 1.1

LOC: 20–A1.3k

TOP: Biosphere

KEY: Trophic level, Structure of Ecosystem

MSC: Knowledge

6. A food chain gives information about who eats whom in an ecosystem. What role do saprophytes, such as fungi, play in a food chain?

A. Producer

B. Primary consumer

C. Secondary consumer

D. Decomposer

ANS: D

The saprophytes act as decomposers in a food chain.

PTS: 1

DIF: Easy

OBJ: Section 1.1

LOC: 20–A1.3k

TOP: Biosphere

KEY: Food Chain, Structure of Ecosystem

MSC: Knowledge

7. Use the information given below to answer the next two questions.

A food chain or a food web gives information about who is eaten by whom. However, the food chains do not provide any information about the biomass present at each trophic level, the energy available to the next trophic level etc. This information is provided by pyramids. Pyramids are of three types; pyramid of energy, of biomass, and of number.

The pyramid of biomass is

A. always upright

B. always inverted

C. inverted for terrestrial ecosystem

D. inverted for ocean habitats

ANS: D

Among the three types of pyramids, only the pyramid of energy is always upright. The pyramid of biomass is upright for terrestrial ecosystem and inverted for aquatic habitats.

PTS: 1

DIF: Easy

OBJ: Section 1.1

LOC: 20–A1.4k

TOP: Biosphere

KEY: Pyramid of biomass

MSC: Knowledge

8. An ecological pyramid of biomass provides information about the amount of biomass present at each trophic level. What is the unit used in the pyramid of biomass?

A. Grams/metre<sup>2</sup>

B. Joules/metre

C. Calories/metre<sup>2</sup>

D. Joules/metre<sup>3</sup>

ANS: A

The most commonly used unit of a pyramid of biomass is grams/metre<sup>2</sup>.

PTS: 1

DIF: Easy

OBJ: Section 1.1

LOC: 20–A1.4k

TOP: Biosphere

KEY: Pyramid of biomass

MSC: Knowledge

9. During the Carbon Cycle, carbon is either taken away or released into the atmosphere. Which of the following rows depicts both the processes correctly?

Row	Carbon added to the atmosphere	Carbon taken away from the atmosphere
A.	Fossil fuel combustion	Photosynthesis
B.	Photosynthesis	Decay of plant matter
C.	Weathering of silicate rock	Photosynthesis
D.	Respiration	Fossil fuel combustion

ANS: A

The burning of fossil fuel results in the addition of carbon dioxide to the atmosphere. The carbon dioxide present in the atmosphere is used up in the process of photosynthesis.

PTS: 1

DIF: Easy

OBJ: Section 1.2

LOC: 20–A2.1k

TOP: Biosphere

KEY: Carbon cycle, biogeochemical cycle

MSC: Knowledge

10. The water cycle is an example of a biogeochemical cycle. However, it also helps in the cycling of other biogeochemicals. Which of the following processes of water cycle helps in the transportation of phosphorus from land to water bodies?

- A. Transpiration
- B. Evaporation
- C. Runoff
- D. Respiration

ANS: C

Runoff is the process occurring during the water cycle that transports phosphorus from land to water bodies.

PTS: 1

DIF: Easy

OBJ: Section 1.2

LOC: 20–A2.2k

TOP: Biosphere

KEY: Water cycle, Biogeochemical cycle

MSC: Knowledge

11. Use the information given below to answer the next question.

The process of transpiration plays an important role in the water cycle. This process adds water to the atmosphere. During transpiration water absorbed by the roots of the plant is lost from the aerial parts of the plant.

Two main properties of water that make the water move from the roots to aerial parts through xylem are     i     and     ii    .

The statement given above is completed by the information in row

Row	i	ii
A	Cohesion	adhesion
B	Cohesion	density
C	Density	specific heat
D	specific heat	adhesion

ANS: A

Cohesion and adhesion are the two main properties of water that help it in moving against the gravity through transpiration.

PTS: 1

DIF: Easy

OBJ: Section 1.2

LOC: 20–A2.2k

TOP: Biosphere

KEY: Biogeochemical cycle

MSC: Knowledge

12. Use the information given below to answer the next two questions.

The amount of organic matter produced per unit area in unit time is known as the productivity of the ecosystem. Four types of ecosystems classified on the basis of productivity are as follows:

- High productive ecosystem ( 2 – 4 kg/m<sup>2</sup>/year)
- Average productive ecosystem (1 – 2 kg/m<sup>2</sup>/year)
- Less productive ecosystem ( 0.2 – 1 kg/m<sup>2</sup>/year)
- Low productive ecosystem (less than 0.2 kg/m<sup>2</sup>/year)

Tropical forests would be classified as:

- A. high productive ecosystem
- B. average productive ecosystem
- C. less productive ecosystem
- D. low productive ecosystem

ANS: A

Tropical forests come under the high productive ecosystem.

PTS: 1

DIF: Easy

OBJ: Section 1.3

LOC: 20–A3.1k

TOP: Biosphere

KEY: Ecosystem productivity

MSC: Knowledge

13. Which of the following ecosystems has the least productivity?

- A. Deserts
- B. Savannas
- C. Coral reefs
- D. Estuaries

ANS: A

The net productivity of deserts is much less in comparison to other ecosystems mentioned above. It is estimated to be about 500 kilocalories/m<sup>2</sup>/year.

PTS: 1            DIF: Easy            OBJ: Section 1.3  
LOC: 20–A3.1k            TOP: Biosphere    KEY: Ecosystem productivity  
MSC: Knowledge

14. The rate of photosynthesis equals the rate of respiration at compensation point. How will a significant increase in the rate of photosynthesis, relative to respiration, impact the atmosphere?

- A. Nitrogen will increase
- B. Nitrogen will decrease
- C. Oxygen will increase
- D. Carbon dioxide will decrease

ANS: D

When the rate of photosynthesis increases, relative to respiration, the amount of CO<sub>2</sub> used up is more than the amount of CO<sub>2</sub> given out. Thus the carbon dioxide content of the atmosphere will decrease.

PTS: 1            DIF: Easy            OBJ: Section 1.3  
LOC: 20–A3.2k            TOP: Biosphere    KEY: Photosynthesis, respiration  
MSC: Knowledge

15. Atmospheric composition is influenced by various processes taking place on the Earth. One such process is   i   that was responsible for the addition of free   ii   to the primitive atmosphere.

The statement given above is completed by the information in row

Row	i	ii
A	respiration	nitrogen
B	respiration	oxygen
C	photosynthesis	oxygen
D	photosynthesis	carbon dioxide

ANS: C

The process of photosynthesis was responsible for the addition of free oxygen into the primitive atmosphere.

PTS: 1

DIF: Easy

OBJ: Section 1.3

LOC: 20–A3.2k

TOP: Biosphere

KEY: Equilibrium between gas exchanges

MSC: Knowledge

16. Use the following information to answer the next two questions.

The primitive atmosphere of the Earth lacked free oxygen. Free oxygen came into existence, and its volume increased in the atmosphere, during the biological era. Today oxygen accounts for about 21% of the Earth's atmosphere. An increase in the amount of free oxygen, during the biological era, resulted in decrease in the volume of a certain gas from the atmosphere.

Which of the following gases decreased while the volume of oxygen increased in the atmosphere during the biological era?

A. Methane

B. Carbon dioxide

C. Argon

D. Nitrogen

ANS: B

The amount of carbon dioxide decreased while the amount of free oxygen increased in the atmosphere during the biological era.

PTS: 1

DIF: Easy

OBJ: Section 1.3

LOC: 20–A3.3k

TOP: Biosphere

KEY: Geological evidence for change in atmospheric composition

MSC: Knowledge

17. The process, responsible for the addition of free oxygen to the present atmosphere, is

A. pedogenesis

B. photosynthesis

C. respiration

D. stratification

ANS: B

Photosynthesis is the process that released bulk of oxygen into the atmosphere.

PTS: 1

DIF: Easy

OBJ: Section 1.3

LOC: 20–A3.3k

TOP: Biosphere

KEY: Geological evidence for change in atmospheric

composition

MSC: Knowledge

18. Different communities and populations form a part of an ecosystem. Which of the following rows differentiates the population from an ecosystem correctly?

Row	Population	Community
A.	Includes individuals of different species	Includes individuals of same species
B.	No interbreeding	Interbreeding is common
C.	Large unit	Small unit
D.	No relationship of eating and being eaten exists	A relationship of eating and being eaten exists

ANS: D

A population includes individuals of same species in an area. Hence, no relationship of eating and being eaten exists. However, in a community different species are present, and so a relationship of eating and being eaten exists.

PTS: 1

DIF: Easy

OBJ: Section 2.1

LOC: 20–B1.1k

TOP: Energy flow, cellular matter

KEY: Community, Population

MSC: Knowledge

19. Species consists of closely related organisms that can interbreed among themselves. A group of individuals of the same species living in a given area is known as a:

- A. Community
- B. Population
- C. Ecosystem
- D. Biome

ANS: B

A group of individuals of the same species living in an area is known as population.

PTS: 1

DIF: Easy

OBJ: Section 2.1

LOC: 20–B1.1k

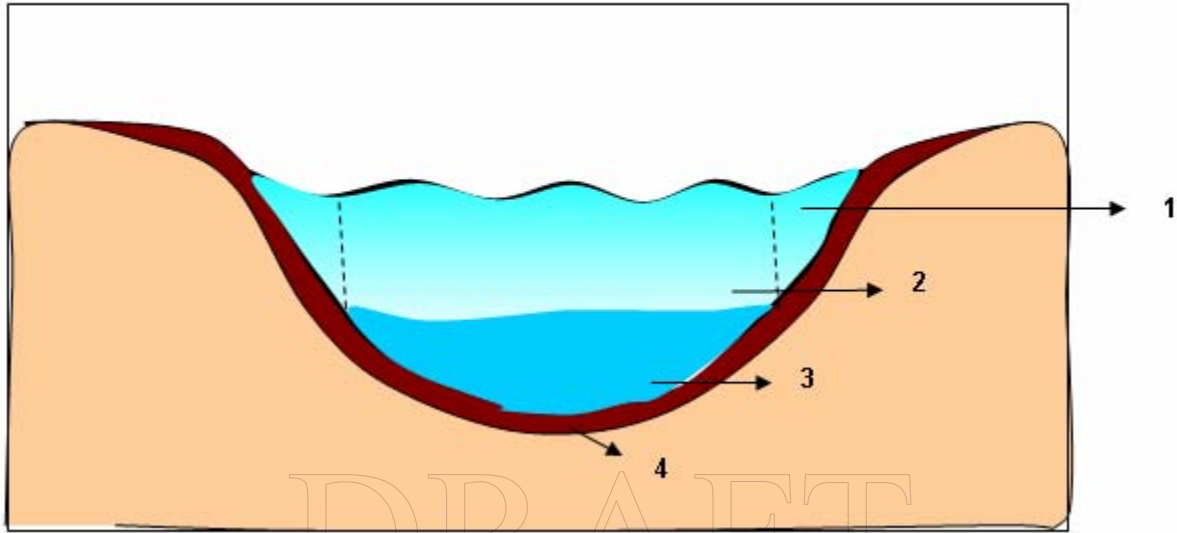
TOP: Energy flow, cellular matter

KEY: Community, Population

MSC: Knowledge

20. Use the following information to answer the next question

### Four Zones of Lake



In the diagram above, the zone of the lake with the maximum biodiversity is numbered

- A. 1
- B. 2
- C. 3
- D. 4

ANS: A

The littoral zone has maximum biodiversity in a lake and it is numbered 1 in the above diagram.

PTS: 1

DIF: Easy

OBJ: Section 2.1

LOC: 20–B1.2k

TOP: Energy flow, cellular matter

KEY: Diversity of living organism

MSC: Knowledge

21. Use the following information to answer the next question.

A forest is usually divided into four layers; upper canopy, understory, shrubby layer, and forest floor. All the four layers may not be distinct in a young forest. Various types of plants and animals can be found in each layer of the forest.

The layer of the forest where we can find animals like rabbits and deer is the

- A. upper canopy
- B. understory layer

C. shrubby layer

D. forest floor

ANS: C

We can find animals like rabbits and deer in the shrubby layer of the forest.

PTS: 1

DIF: Easy

OBJ: Section 2.1

LOC: 20–B1.2k

TOP: Energy flow, cellular matter

KEY: Diversity of living organism

MSC: Knowledge

22. Use the following information to answer the next question.

An ecosystem is influenced by two types of factors; biotic and abiotic. Biotic factors include the influences caused by living organisms to an ecosystem. Abiotic factors include the non living factors impacting an ecosystem.

Which of the following rows matches the abiotic factor, with the way it impacts an ecosystem, correctly?

Row	Abiotic factor	Effect on an ecosystem
A.	Fire	Seasonal changes
B.	Temperature	Recycles nutrients
C.	Latitude	Changes density of water
D.	Topography of land	Affects the climate

ANS: D

The topography of the land is an abiotic factor that impacts the climate.

PTS: 1

DIF: Easy

OBJ: Section 2.1

LOC: 20–B1.3k

TOP: Energy flow, cellular matter

KEY: Abiotic factors

MSC: Knowledge

23. Use the following information to answer the next question.

Carl Woese, in 1990, introduced a three domain system of biological classification. According to this system of classification, living organisms are grouped into Archaea, Bacteria and Eukaryota. This system is based on the genetic sequence analysis and cladistics of living organisms.

During the scientific classification, the domain comes prior to the taxon

- A. order
- B. class
- C. phylum
- D. kingdom

ANS: D

A domain is the highest taxon of scientific classification, and it is followed by kingdom.

PTS: 1

DIF: Easy

OBJ: Section 2.1

LOC: 20–B1.5k

TOP: Energy flow, cellular matter

KEY: Taxonomy

MSC: Knowledge

24. Use the following information to answer the next question.

Binomial nomenclature is a method of naming all the known species of the world in two terms. The first term represents the genus name and the second term represents the species name. The nomenclature system we use today was introduced by Carolus Linnaeus in 18<sup>th</sup> century. There are a few rules that are followed while writing scientific names.

One of the rules, followed while writing scientific name, is that the

- A. species name begins with capital letter
- B. scientific name is printed in italics
- C. genus name begins with small letter
- D. genus name is underlined

ANS: B

The scientific name is printed in italics.

PTS: 1

DIF: Easy

OBJ: Section 2.1

LOC: 20–B1.5k

TOP: Energy flow, cellular matter

KEY: Binomial nomenclature

MSC: Knowledge

25. Variations in a gene pool may occur due to mutation. Mutation can be useful, harmful or even neutral.

Which of the following processes helps in the removal of harmful mutations from a gene pool?

- A. Natural selection
- B. Linkage

- C. Crossing over
- D. Self fertilization

ANS: A

Natural selection helps in the removal of harmful mutations from a gene pool.

PTS: 1                      DIF: Easy                      OBJ: Section 2.2  
LOC: 20–B2.1k      TOP: Energy flow, cellular matter      KEY: Mutation, Variations in a gene pool  
MSC: Knowledge

26. Use the following information to answer the next question.

Penicillin destroys bacterial cell wall and it also affects the ability of the bacteria to synthesize the cell wall. Thus the bacterial wall collapses and the bacterial cell dies. However, certain bacteria are resistant and produce enzymes that destroy penicillin. The ribosome of the resistant bacteria is slightly different and thus the drug cannot bind at this place.

The drug resistant bacteria show the phenomenon of

- A. selectable mutation not bio 20 terminology. Change to ‘natural selection’
- B. non-selectable mutation not bio 20 wording. Change to ‘use and disuse of organs’
- C. artificial selection
- D. artificial insemination

ANS: A

The bacteria become resistant to penicillin as a result of natural selection.

PTS: 1                      DIF: Easy                      OBJ: Section 2.2  
LOC: 20–B2.1k      TOP: Energy flow, cellular matter      KEY: Mutation, Variations in a gene pool  
MSC: Knowledge

27. Sexual reproduction combines genetic information of two parents and this leads to variation among individuals. These variations are passed on to an increasing number of organisms in the population. The main source of variation is

- A. artificial selection
- B. mutation
- C. isolation
- D. speciation

ANS: B

Mutation is the main source of variation. Mutations occurring in the reproductive cells are the ones that are passed on to the offspring.

PTS: 1

DIF: Easy

OBJ: Section 2.2

LOC: 20–B2.2k

TOP: Energy flow, cellular matter

KEY: Genetic Variations

MSC: Knowledge

28. All living organisms on the Earth reproduce sexually which promotes genetic variability among individuals of a population. One source of this variation is due to mutation and it leads to an increase in the rate of

- A. polymorphism
- B. maturation
- C. extinction
- D. evolution

ANS: D

The genetic variability leads towards evolution.

PTS: 1

DIF: Easy

OBJ: Section 2.2

LOC: 20–B2.2k

TOP: Energy flow, cellular matter

KEY: Genetic Variations, Evolution

MSC: Knowledge

29. Use the following information to answer the next two questions

Jean Baptiste de Lamarck published his theory of evolution in 1809 in his book '*Philosophie Zoologique*'. Lamarck's theory of evolution is also known as Lamarckism. Lamarckism was widely accepted until Darwin's theory was published in his book '*On the Origin of Species*'. The laws proposed by Mendel later led to the development of modern evolutionary synthesis, which is also known as neo-Darwinism.

Which of the following are not associated with Darwin's theory of evolution

- A. Variation within a population
- B. Use and disuse of organs
- C. Natural selection
- D. Sexual selection

ANS: B

Lamarck, and not Darwin, was of the view that evolution occurred as a result of use and disuse of organs.

PTS: 1

DIF: Easy

OBJ: Section 2.2

LOC: 20–B2.3k

TOP: Energy flow, cellular matter

KEY: Lamarckism, Darwinism

MSC: Knowledge

30. Which of the following rows correctly describes the basis of Lamarckism and Darwinism?

Row	Lamarck	Darwin
A.	Artificial selection	inheritance of acquired characters
B.	Natural selection	inheritance of acquired characters
C.	Natural selection	Crossing over
D.	Inheritance of acquired characters	Natural selection

ANS: D

Lamarckism is based on the theory of inheritance of acquired characters and Darwinism is based on the idea of natural selection.

PTS: 1

DIF: Easy

OBJ: Section 2.2

LOC: 20–B2.3k

TOP: Energy flow, cellular matter

KEY: Lamarckism, Darwinism

MSC: Knowledge

31. Use the following information to answer the next two questions.

The term speciation refers to the evolution of new species from pre-existing species. Speciation can be artificial or natural. Natural speciation is of four types. Various populations of wandering animals and plants of South America colonized Galapagos Islands and gave rise to species which now dwell in the island. This is a type of speciation.

The above mentioned speciation is an example of

- A. peripatric speciation
- B. parapatric speciation
- C. allopatric speciation
- D. sympatric speciation

ANS: C

The above mentioned speciation is an example of allopatric speciation.

PTS: 1

DIF: Difficult

OBJ: Section 2.2

LOC: 20–B2.5k

TOP: Energy flow, cellular matter

KEY: Speciation

MSC: Knowledge

32. The type of speciation in which genetic polymorphism plays an important role is

- A. peripatric speciation
- B. parapatric speciation
- C. allopatric speciation
- D. sympatric speciation

ANS: D

Sympatric speciation occurs within the population and genetic polymorphism plays an important role in it.

PTS: 1

DIF: Difficult

OBJ: Section 2.2

LOC: 20–B2.5k

TOP: Energy flow, cellular matter

KEY: Speciation

MSC: Knowledge

33. Use the following information to answer the next two questions.

During 1960's Steven J Gould proposed the punctuated equilibrium theory of evolution. This theory suggests that population occurs in spurts. The punctuated equilibrium is considered to be opposing the theory of gradualism. However, this is a misconception. When clearly analyzed, the punctuated equilibrium theory seems to be a form of gradualism.

On what evidences did Gould seek to prove his theory as an improvement over Charles Darwin's theory of gradualism?

- A. Embryological evidences
- B. Paleontological evidences
- C. Anatomical evidences
- D. Morphological evidences

ANS: B

According to Steven J Gould, there were no fossil records to prove Darwin's theory of gradualism.

PTS: 1                    DIF: Easy                    OBJ: Section 2.2  
LOC: 20–B2.6k    TOP: Energy flow, cellular matter    KEY: Punctuated equilibrium, Gradualism  
MSC: Knowledge

34. The punctuated equilibrium model agrees with the theory of gradualism on the idea of
- A. use and disuse theory
  - B. mutation
  - C. natural selection
  - D. artificial insemination

ANS: C

Certain points of the punctuated equilibrium theory oppose the theory of gradualism. However, both the theories agree on the idea of natural selection.

PTS: 1                    DIF: Easy                    OBJ: Section 2.2  
LOC: 20–B2.6k    TOP: Energy flow, cellular matter    KEY: Punctuated equilibrium, Gradualism  
MSC: Knowledge

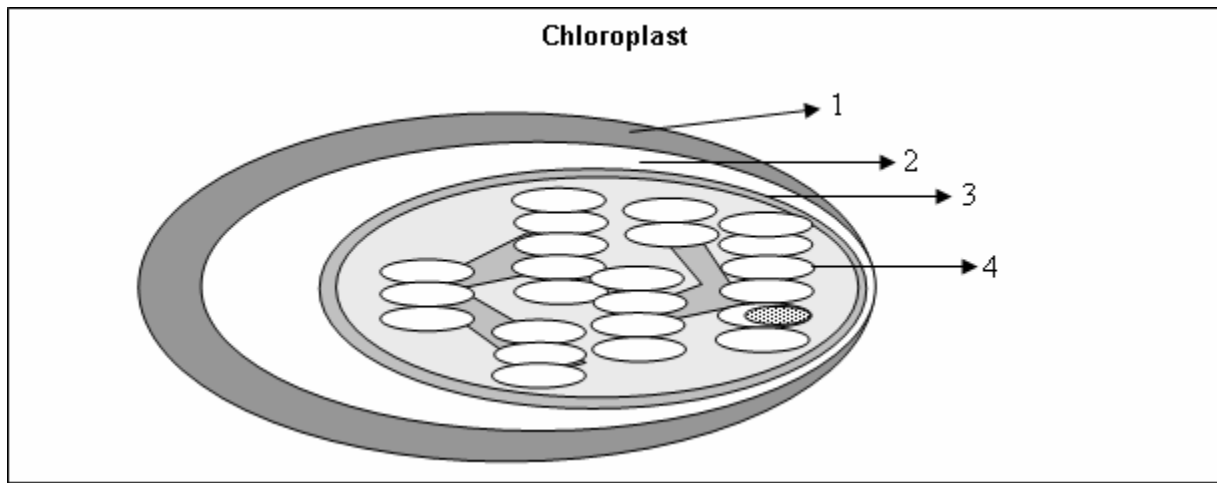
35. NADPH is produced during the light dependent reaction of photosynthesis. It is utilized during the Calvin cycle of photosynthesis. NADPH is produced during the
- A. photolysis of water
  - B. cyclic photophosphorylation
  - C. non cyclic photophosphorylation
  - D. absorption of light

ANS: C

NADPH is produced during non cyclic photophosphorylation.

PTS: 1                    DIF: Easy                    OBJ: Section 3.1  
LOC: 20–C1.1k            TOP: Energy & matter exchange in ecosystem  
KEY: Pigments, absorption of light by chlorophyll    MSC: Knowledge

36. Use the following information to answer the next question.



In the diagram above, the part of the chloroplast that is involved in the process of chemiosmosis is numbered

- A. 1
- B. 2
- C. 3
- D. 4

ANS: D

The thylakoid membranes are involved with the process of chemiosmosis that occurs during the light dependent phase of photosynthesis.

PTS: 1

DIF: Easy

OBJ: Section 3.1

LOC: 20-C1.1k

TOP: Energy & matter exchange in ecosystem

KEY: Pigments, absorption of light by chlorophyll, Chemiosmosis

MSC: Knowledge

37. Use the following information to answer the next question.

Two stages of photosynthesis are the light dependent stage and the light independent stage. Carbon fixation occurs during the light independent stage of photosynthesis.

Where does carbon fixation occur in the chloroplast?

- A. Inner membrane
- B. Outer membrane
- C. Grana
- D. Stroma

ANS: D

Carbon fixation occurs in the stroma of the chloroplast.

PTS: 1

DIF: Easy

OBJ: Section 3.1

LOC: 20–C1.2k

TOP: Energy & matter exchange in ecosystem

KEY: Carbon fixation

MSC: Knowledge

38. Use the following information to answer the next question.

A series of biochemical reactions occur during the Calvin cycle. Calvin cycle is also known as  $C_3$  cycle. In the first step of Calvin cycle a three carbon compound 3-phosphoglyceric acid is formed.

Which of the following enzymes catalyzes the first step of Calvin cycle?

- A. Ribose isomerase
- B. Transketolase
- C. Phosphopentose epimerase
- D. Rubisco

ANS: D

The first step of the Calvin cycle is catalyzed by Rubisco enzyme.

PTS: 1

DIF: Easy

OBJ: Section 3.1

LOC: 20–C1.2k

TOP: Energy & matter exchange in ecosystem

KEY: Calvin cycle

MSC: Knowledge

39. Use the following information to answer the next question.

Glycolysis is a process that oxidizes glucose to pyruvic acid. The process of glycolysis breaks a glucose molecule into two molecules of pyruvic acid. Certain molecules of ATP are also produced during the process of glycolysis.

What is the net gain of ATP molecules if five molecules of glucose enter the process of glycolysis?

- A. 2
- B. 5
- C. 10
- D. 15

ANS: C

There is a net gain of two ATP molecules from one molecule of glucose entering the process of glycolysis. Thus five molecule of glucose will result in net production of 10 ATP molecules.

PTS: 1

DIF: Easy

OBJ: Section 3.2

LOC: 20–C2.1k

TOP: Energy & matter exchange in ecosystem

KEY: Glycolysis

MSC: Knowledge

40. Use the following information to answer the next question.

Glycolysis results in the production of pyruvic acid, which undergoes oxidative decarboxylation to form acetyl co A. The Acetyl-Co A enters the Krebs cycle to continue the respiratory process.

Where, in the cell, does Krebs cycle take place?

- A. Mitochondrial matrix
- B. Mitochondrial granule
- C. Endoplasmic reticulum
- D. Nuclear membrane

ANS: A

Krebs cycle takes place in the matrix of mitochondria.

PTS: 1

DIF: Easy

OBJ: Section 3.2

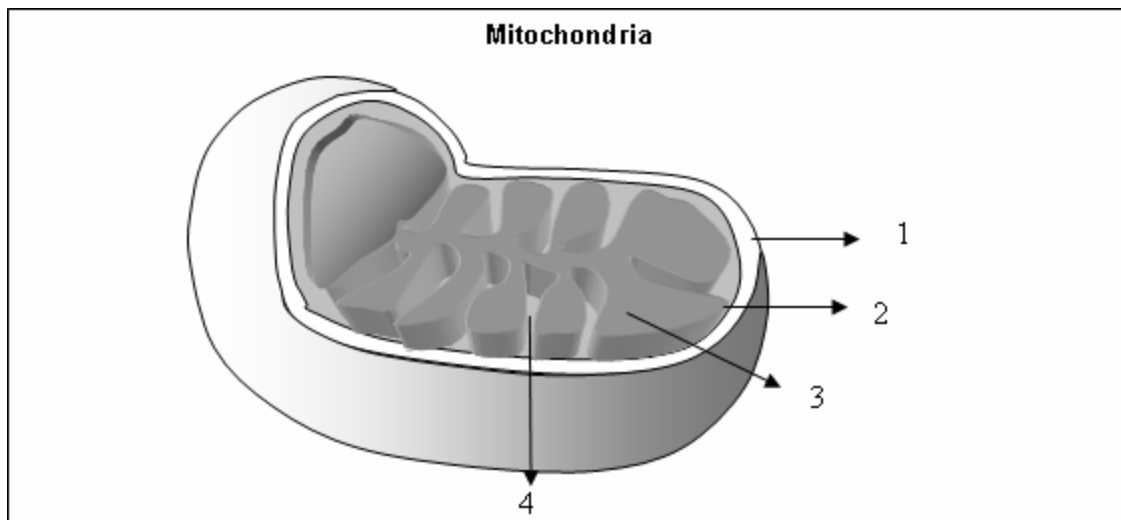
LOC: 20–C2.1k

TOP: Energy & matter exchange in ecosystem

KEY: Krebs cycle

MSC: Knowledge

41. Use the following information to answer the next question.



In the diagram above, the part of mitochondria where the process of chemiosmosis occurs is numbered

- A. 1
- B. 2
- C. 3
- D. 4

ANS: D

Chemiosmosis in mitochondria occurs in the crista.

PTS: 1

DIF: Easy

OBJ: Section 3.2

LOC: 20–C2.2k

TOP: Energy & matter exchange in ecosystem

KEY: Chemiosmosis

MSC: Knowledge

42. Use the following information to answer the next two questions.

Respiration is of two types; aerobic respiration and anaerobic respiration. Glycolysis is the common process in both types of respiration. However, pyruvic acid metabolism differs in case of aerobic respiration. The pyruvic acid undergoes a process known as fermentation during anaerobic respiration. Aerobic respiration results in the production of 36 ATP molecules from one molecule of glucose.

What is the number of ATP molecules produced from one molecule of glucose, during anaerobic respiration?

- A. 2
- B. 4
- C. 6

D. 8

ANS: A

Two molecules of ATP are produced from one molecule of glucose during anaerobic respiration.

PTS: 1

DIF: Easy

OBJ: Section 3.2

LOC: 20–C2.3k

TOP: Energy & matter exchange in ecosystem

KEY: Anaerobic respiration

MSC: Knowledge

43. During strenuous exercise a type of fermentation occurs in our muscle cells. The product formed from this type of fermentation in our muscle cells is

- A. lactic acid
- B. acetic acid
- C. acetyl-Co A
- D. ethanol

DRAFT

ANS: A

Lactic acid fermentation occurs in the muscle cells during strenuous exercise and the product formed is lactic acid.

PTS: 1

DIF: Easy

OBJ: Section 3.2

LOC: 20–C2.3k

TOP: Energy & matter exchange in ecosystem

KEY: Fermentation

MSC: Knowledge

For Evaluation  
Purposes Only

44. ATP is also known as the universal energy currency. It plays an important role in major cellular processes. Energy is not used in the form of ATP during

- A. photosynthesis
- B. glycolysis
- C. active transport
- D. osmosis

ANS: D

Chemical energy is not required during the process of passive transport.

PTS: 1

DIF: Easy

OBJ: Section 3.2

LOC: 20–C2.4k

TOP: Energy & matter exchange in ecosystem

KEY: ATP

MSC: Knowledge

45. Use the following information to answer the next question.

The adenosine triphosphate (ATP) plays an important role in cellular metabolism. It also provides energy required during muscle contraction, blood circulation etc.

When energy from the ATP is utilized during cell metabolism, it gets converted into

- A. ADP
- B. AMP
- C. Phosphate ions
- D. Phosphite ions

ANS: A

When an ATP molecule is spent, it gets converted to ADP.

PTS: 1

DIF: Easy

OBJ: Section 3.2

LOC: 20–C2.4k

TOP: Energy & matter exchange in ecosystem

KEY: ATP

MSC: Knowledge

46. The term protein is derived from a Greek word 'prota' which means of primary importance. The building blocks of proteins are amino acids that are joined together by peptide bonds present between the \_\_\_\_\_ i \_\_\_\_\_ group and \_\_\_\_\_ ii \_\_\_\_\_ group of adjacent amino acid. The statement given above is completed by the information in row

Row	i	ii
A	carboxyl	amino
B	amino	hydroxyl
C	carboxyl	hydroxyl
D	amino	amino

ANS: A

The amino acids of protein are joined together by peptide bonds present between the carboxyl group and amino group of adjacent amino acid.

PTS: 1

DIF: Easy

OBJ: Section 4.1

MSC: Knowledge

47. Lipase is an enzyme that helps in the digestion of lipids. The products of fat digestion are   i   and   ii  . The statement given above is completed by the information in row

Row	i	ii
A.	peptides	glycerol
B.	fatty acids	glycerol
C.	fatty acids	amino acids
D.	amino acids	glucose

ANS: B

Lipases are water soluble enzymes and they help in the breakdown of fats into fatty acids and glycerol.

PTS: 1

DIF: Easy

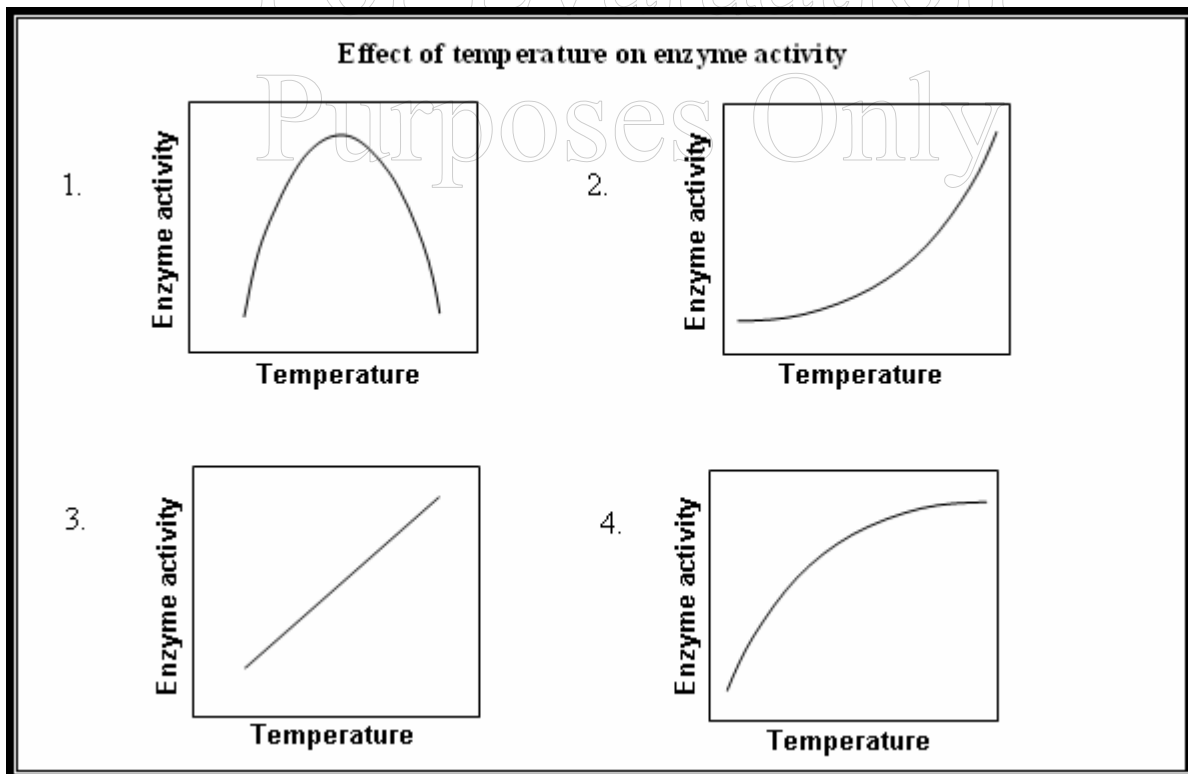
OBJ: Section 4.1

LOC: 20–D1.2k TOP: Energy & matter exchange by Human organism

KEY: Fats

MSC: Knowledge

48. Use the following information to answer the next question.



Various factors such as the temperature, pH, concentration of enzymes affects their activity. The graph that shows how temperature affects enzyme activity is numbered

- A. 1
- B. 2
- C. 3
- D. 4

ANS: A

Enzyme activity increases with increase in temperature. However; higher temperature results in the denaturation of enzymes. The graph that shows how temperature affects enzyme activity is numbered

PTS: 1

DIF: Easy

OBJ: Section 4.1

LOC: 20–D1.3k

TOP: Energy & matter exchange by Human organism

KEY: Enzyme activity

MSC: Knowledge

49. Use the following information to answer the next question.

Enzymes are biocatalysts that catalyze various chemical reactions occurring in the body. They are proteins that speed up the rate of chemical reactions. Enzymes can increase the rate of reaction, up to millions of times, in comparison to an uncatalyzed reaction.

Enzymes speed up the rate of reaction by

- A. undergoing a chemical change in itself
- B. lowering the activation energy
- C. increasing the temperature
- D. decreasing the temperature

ANS: B

An enzyme lowers the activation energy of the reactions taking place in the body, and thus increases the rate of reaction.

PTS: 1

DIF: Easy

OBJ: Section 4.1

LOC: 20–D1.3k

TOP: Energy & matter exchange by Human organism

KEY: Enzyme activity

MSC: Knowledge

50. The large intestine, also known as colon, is mainly associated with the function of absorption of water. A restricted re-absorption of water by the large intestine, due to an infection, may result in a disorder known as   i  , and an excessive re-absorption of water may result in a disorder known as   ii  . The statement given above is completed by the information in row

Row	i	ii
A	diarrhea	constipation
B	constipation	diarrhea
C	dehydration	diarrhea
D	constipation	gastritis

ANS: A

An excessive re-absorption of water by colon results in constipation and a restricted re-absorption of water results in diarrhea.

PTS: 1

DIF: Easy

OBJ: Section 4.1

LOC: 20–D1.4k

TOP: Energy & matter exchange by Human organism

KEY: Digestive system

MSC: Knowledge

51. Use the following information to answer the next question.

Human heart is a four chambered pumping organ. The left side of our heart pumps oxygenated blood and the right side of the heart pumps deoxygenated blood.

The structure that prevents the backflow of the blood from the ventricle to the atria is a/the

- A. valve
- B. septa
- C. sinoatrial node
- D. atrioventricular node

ANS: A

The valves maintain the unidirectional flow of blood in the heart.

PTS: 1

DIF: Easy

OBJ: Section 4.2

LOC: 20–D2.1k

TOP: Energy & matter exchange, Human organism

KEY: Circulatory system

MSC: Knowledge

52. Human beings have a double circulatory system in which two separate systems; pulmonary and systemic circulation occurs. During systemic circulation \_\_\_i\_\_\_ blood is carried away from the heart and during pulmonary circulation \_\_\_ii\_\_\_ blood is carried away from the heart. The statement given above is completed by the information in row

Row	i	ii
A.	oxygenated	deoxygenated
B.	deoxygenated	deoxygenated
C.	oxygenated	oxygenated
D.	deoxygenated	oxygenated

ANS: A

The systemic circulation is related with carrying away of oxygenated blood from the heart, and the pulmonary circulation is related with the carrying away of deoxygenated blood from the heart.

PTS: 1

DIF: Easy

OBJ: Section 4.2

LOC: 20–D2.2k

TOP: Energy & matter exchange by Human organism

KEY: Circulatory system

MSC: Knowledge

53. The arteries are the blood vessels that carry the blood away from the heart and veins are the blood vessels that carry blood towards the heart. Which of the following rows matches the blood vessel with the type of blood it carries?

Row	Blood vessel	Type of blood
A.	Hepatic vein	Oxygenated blood
B.	Pulmonary vein	Oxygenated blood
C.	Renal artery	Deoxygenated blood
D.	Hepatic artery	Deoxygenated blood

ANS: B

The pulmonary vein carries oxygenated blood from the lungs to the heart.

PTS: 1

DIF: Easy

OBJ: Section 4.2

LOC: 20–D2.3k

TOP: Energy & matter exchange, human organism

KEY: Circulatory system, Arteries and veins

MSC: Knowledge

54. Use the following information to answer the next question.

Blood is a circulating tissue that consists of various types of cells; white blood cells, red blood cells and platelets suspended in a fluid known as plasma.

The red blood cells differ from the other cells of the body in that they have   i   and they lack   ii  . The statement given above is completed by the information in row

Row	i	ii
A.	hemoglobin	nucleus
B.	nucleus	hemoglobin
C.	nucleus	cell membrane
D.	cell membrane	hemoglobin

ANS: A

The red blood cells lack nucleus and have hemoglobin in their cytoplasm.

PTS: 1

DIF: Easy

OBJ: Section 4.2

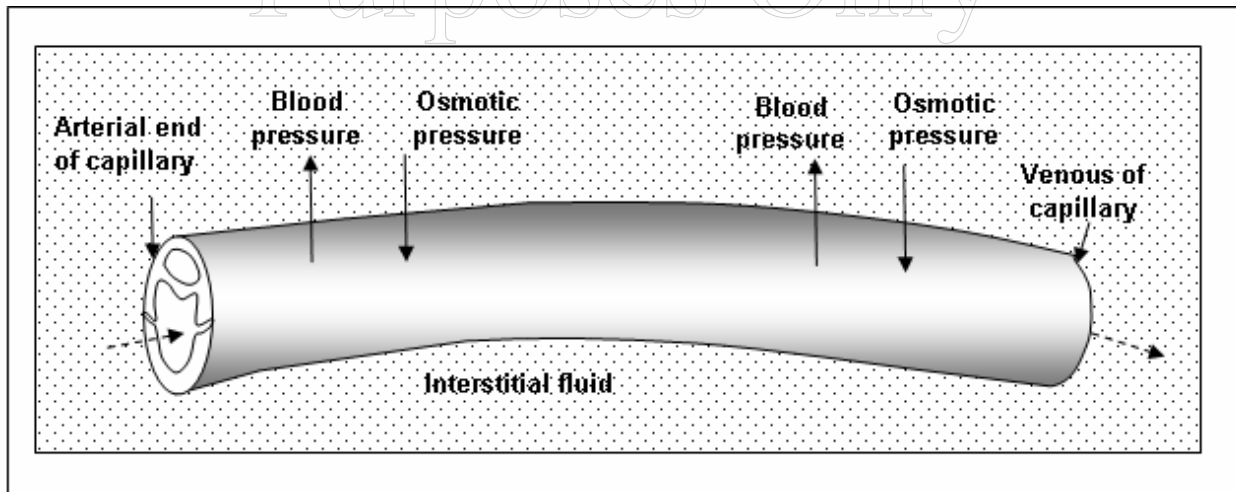
LOC: 20–D2.4k

TOP: Energy & matter exchange by Human organism

KEY: Blood

MSC: Knowledge

55. Use the following information to answer the next question.



Starling's Hypothesis showing the exchange of material between a capillary and the interstitial fluid.

The blood pressure is   i   than the osmotic pressure at the arterial end of capillaries and it is   ii   than the osmotic pressure at the venous end of the capillaries. The statement given above is completed by the information in row:

Row	i	ii
A	higher	lower
B	higher	higher
C	lower	lower
D	lower	higher

ANS: A

The blood pressure is higher than the osmotic pressure at the arterial end of the capillaries. At the venous end the blood pressure is lower than the osmotic pressure.

PTS: 1                      DIF: Easy                                      OBJ: Section 4.2  
 LOC: 20–D2.5k      TOP: Energy & matter exchange by Human organism      KEY: Capillaries  
 MSC: Knowledge

56. When an individual is running or working out,   i   blood passes beneath the skin and   ii   is lost by the body to help maintain body temperature. The statement given above is completed by information in which of the following rows:

Row	i	ii
A.	more	oxygen
B.	less	sweat
C.	less	oxygen
D.	more	sweat

ANS: D

More heat is lost by the body because more blood is passing by the surface of the skin. Perspiration takes place when an individual exerts themselves for a period of time.

PTS: 1                      DIF: Easy                                      OBJ: Section 4.2  
 LOC: 20–D2.6k      TOP: Energy & matter exchange by Human organism      KEY: Functions of blood  
 MSC: Knowledge

57. Use the following information to answer the next question.

The lymph nodes of the lymphatic system contain macrophages. Macrophages trap and destroy the bacteria that are circulating in the body.

Macrophages engulf and destroy bacteria by a process known as

- A. pinocytosis
- B. phagocytosis
- C. apoptosis
- D. dialysis

ANS: B

Macrophages are phagocytic in nature.

PTS: 1

DIF: Easy

OBJ: Section 4.2

LOC: 20–D2.7k

TOP: Energy & matter exchange by Human organism

KEY: Lymphatic system

MSC: Knowledge

58. Lymphocytes play an important role in the body's defense mechanism. They are divided into two specialized groups B lymphocytes and T lymphocytes, also known as B cells and T cells respectively. The B cells mature in the   i   and the T cells mature in the   ii  . The statement given above is completed by the information in row

Row	i	ii
A	bone marrow	thymus gland
B	thymus gland	bone marrow
C	brain	thyroid gland
D	thyroid gland	bone marrow

ANS: A

B cells mature in the bone marrow and the T cells mature in the thymus gland. Ans A

PTS: 1

DIF: Easy

OBJ: Section 4.2

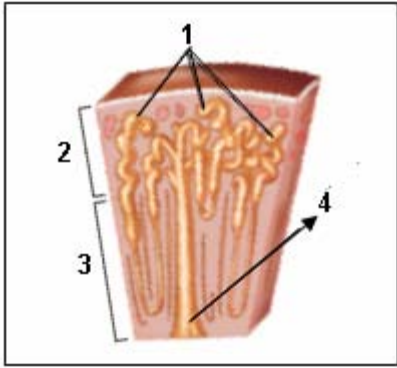
LOC: 20–D2.8k

TOP: Energy & matter exchange by Human organism

KEY: Immune system, Defense system

MSC: Knowledge

59. Use the following information to answer the next question.



In the diagram above, the renal cortex of the kidney is numbered

- A. 1
- B. 2
- C. 3
- D. 4

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ANS: B

The renal cortex is numbered 2 in the above diagram.

PTS: 1

DIF: Easy

OBJ: Section 4.3

LOC: 20–D3.1k

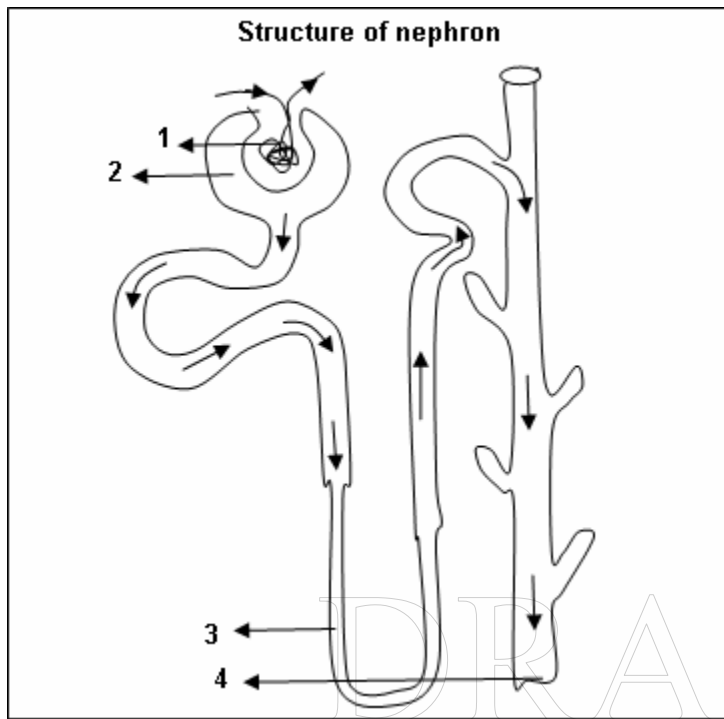
TOP: Energy & matter exchange, human organism

KEY: Excretory system

MSC: Knowledge

Purposes Only

60. Use the following information to answer the next question.



In the diagram above, the glomerulus present in the nephron is numbered

- A. 1
- B. 2
- C. 3
- D. 4

ANS: A

The glomerulus present in the nephron is numbered 1.

PTS: 1

DIF: Easy

OBJ: Section 4.3

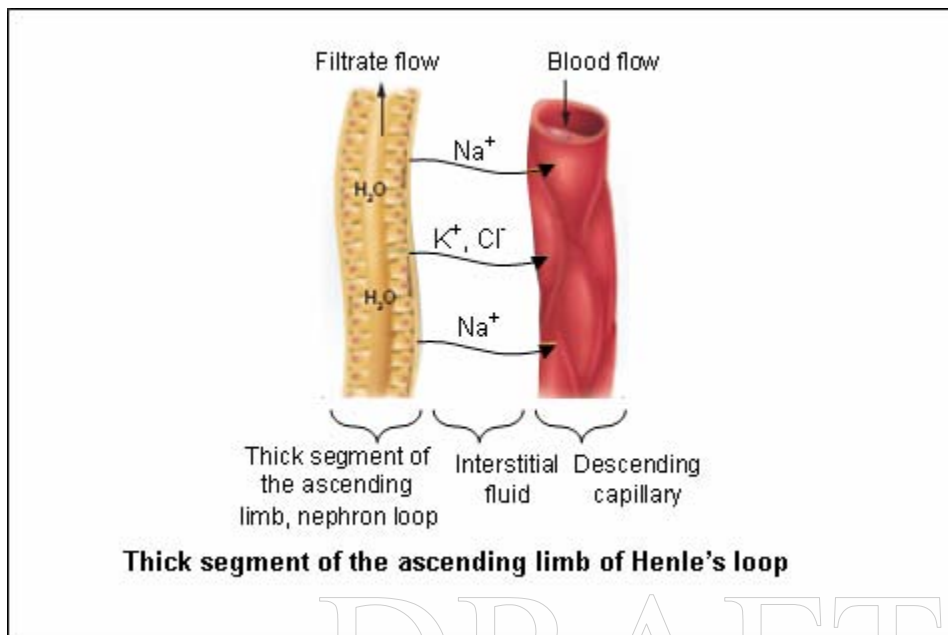
LOC: 20–D3.2k

TOP: Energy & matter exchange, human organism

KEY: Excretory system

MSC: Knowledge

61. Use the following information to answer the next question.



The above diagram represents a segment of the ascending limb of the Henle's loop. The sodium ions are transported to the descending capillary by   i   transport and the potassium ions are transported to the same by   ii   transport. The statement given above is completed by the information in row

Row	i	ii
A	active	passive
B	passive	active
C	active	active
D	passive	passive

ANS: A

The sodium ions are transported to the descending capillary by active transport and the potassium ions are transported to the descending capillary by passive transport.

PTS: 1

DIF: Easy

OBJ: Section 4.3

LOC: 20-D3.2k

TOP: Energy & matter exchange by Human organism

KEY: Excretory system

MSC: Knowledge

62. Nephrons are the structural and functional unit of the kidney. Which of the following rows correctly matches the part of a nephron with its excretory function?

Row	Structures of nephron	Function
-----	-----------------------	----------

A.	Descending loop of Henle	Active reabsorption of sodium ions
B.	Proximal tubule	Active reabsorption of glucose
C.	Collecting tube	Reception of glomerular filtrate
D.	Bowman's capsule	Reabsorption of water

ANS: B

The proximal tube is associated with the function of active secretion of hydrogen ions.

PTS: 1

DIF: Easy

OBJ: Section 4.3

LOC: 20–D3.3k

TOP: Energy & matter exchange, human organism

KEY: Excretory system

MSC: Knowledge

63. The amount of water that is reabsorbed or excreted in urine is controlled by the release of the hormone

- A. PTH
- B. LH
- C. FSH
- D. ADH

ANS: D

Antidiuretic hormone (ADH) controls the amount of water that is reabsorbed or excreted in urine.

PTS: 1

DIF: Easy

OBJ: Section 4.3

LOC: 20–D3.3k

TOP: Energy & matter exchange by Human organism

KEY: Excretory system

MSC: Knowledge

64. All of the following are associated with the contraction of a skeletal muscle except the:

- A. utilization of energy
- B. synthesize ATP
- C. release heat
- D. stabilization of joints

ANS: B

During contraction, the skeletal muscles cause the breakdown of ATP which results in the release of a considerable amount of heat.

PTS: 1

DIF: Easy

OBJ: Section 4.4

65. The mechanism of muscle contraction is best explained by the sliding filament theory. According to this theory, the thin   i   filament slides over the thick   ii   filament. The statement given above is completed by information in row:

Row	i	ii
A.	myosin	actin
B.	myosin	myosin
C.	actin	actin
D.	actin	myosin

ANS: D

According to the sliding filament theory, the thin actin filaments slide over the thick myosin filaments.

PTS: 1

DIF: Easy

OBJ: Section 4.4

LOC: 20–D4.2k

TOP: Energy & matter exchange, human organism

KEY: Actin, Myosin

MSC: Knowledge

66. The coordinated action of two types of myofilaments; actin and myosin results in muscle contraction. The muscles contract due to the sliding of the actin filaments over the myosin filaments. When the muscle is in relaxed state, the myosin heads are ready to bind with the actin filament. However, they are not able to bind with actin filaments due to

- A. the absence of ATP
- B. high concentration of  $\text{Ca}^{++}$  ions
- C. the blockage of the attachment site
- D. alcoholic fermentation

ANS: C

During relaxed state, the myosin heads are unable to bind with the actin filament because the attachment site of actin is blocked by a protein called topomysin.

PTS: 1

DIF: Easy

OBJ: Section 4.4

LOC: 20–D4.2k

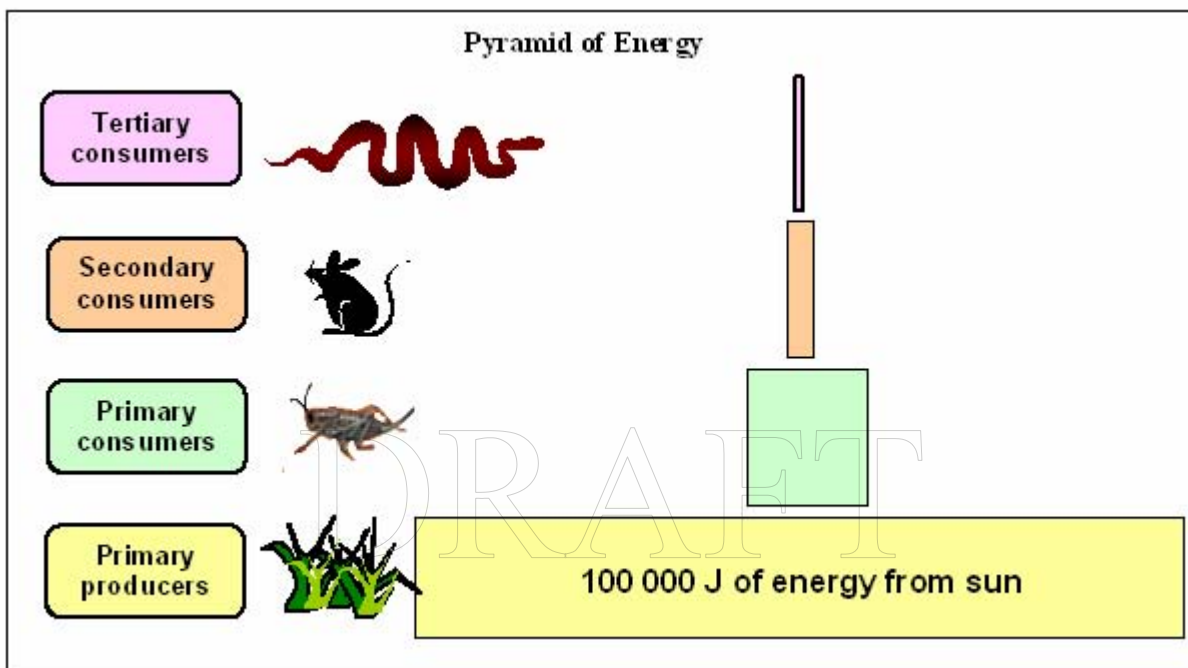
TOP: Energy & matter exchange by Human organism

KEY: Actin, Myosin

MSC: Knowledge

## NUMERIC RESPONSE

1. Use the information given below to answer the next question.



If the producers in the food chain shown above captured 100 000 J of energy from sun, the approximate amount of energy that the snake obtains is \_\_\_\_\_ J.  
(Record your answer in the numerical-response section on the answer sheet.)

ANS: 100 J

About 10% of the available energy is passed to the next trophic level in a food chain. Since the grass obtains 100 000 J, ten per cent thereof i.e. 10 000 J is passed on to the insect and from the insect 1000 J of energy is passed on to the mice. Finally 100 J of energy is passed on to the snake.

PTS: 1

DIF: Easy

OBJ: Section 1.1

LOC: 20–A1.4k

TOP: Biosphere

KEY: Pyramid of Energy

MSC: Knowledge

2. The Calvin cycle utilizes the products of the light dependent reaction (ATP and NADPH) and converts  $\text{CO}_2$  into glucose. Some of the products formed at various steps of Calvin cycle are as follows:

1. ribulose 5-phosphate
2. glyceraldehydes 3-phosphate
3. 1,3-diphosphoglyceric acid

4. 3-phosphoglyceric acid

The order in which the products listed above are formed during Calvin cycle is \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.

(Record all four digits of your answer in the numerical-response section on the answer sheet.)

ANS: 4, 3, 2, 1    PTS: 1    DIF: Easy    OBJ: Section 3.1  
LOC: 20–C1.2k    TOP: Energy & matter exchange in ecosystem    KEY: Calvin cycle  
MSC: Knowledge

3. The digestive system of human beings consists of alimentary canal and digestive glands. The alimentary canal starts with the mouth and ends with the anus. Some of the organs of the alimentary canal include

1. Small intestine
2. Large intestine
3. Esophagus
4. Stomach

The order in which the organs listed above follow each other, starting from the mouth, is \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.

(Record all four digits of your answer in the numerical-response section on the answer sheet.)

ANS: 3, 4, 1, 2    PTS: 1    DIF: Easy    OBJ: Section 4.1  
LOC: 20–D1.1k    TOP: Energy & matter exchange by Human organism    KEY: Digestive system  
MSC: Knowledge

4. Use the following information to answer the next question.

The respiratory system of human beings is divided into upper respiratory tract and lower respiratory tract. Some of the respiratory organs and their characteristics are given below.

- |  |           |
|--|-----------|
| 1. Contains vocal cords                      | Larynx    |
| 2. Also known as wind pipe                   | Trachea   |
| 3. Cluster of air sacs                       | Alveoli   |
| 4. Separates lungs from the abdominal cavity | Diaphragm |

Using the numbers above, match the above mentioned characteristics with the organs they are related with.

Characteristics \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Organs: Trachea Larynx Alveoli Diaphragm

(Record all four digits of your answer in the numerical-response section on the answer sheet.)

ANS: 2, 1, 3, 4 PTS: 1 DIF: Easy OBJ: Section 4.1  
LOC: 20–D1.1k TOP: Energy & matter exchange by Human organism KEY: Respiratory system  
MSC: Knowledge

5. The food we take in passes through the alimentary canal where it is digested and the final unwanted waste is expelled. While passing through the alimentary canal, the food undergoes various physical and chemical changes, some of which are listed below.

1. Mastication of food
2. Initial Digestion of proteins
3. Emulsification of fats
4. Absorption of water

Using the numbers above, match the above mentioned steps of digestive system, with the organs where they occur.

Changes during digestion: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.

Organs: Stomach Small Intestine Mouth large intestine

(Record all four digits of your answer in the numerical-response section on the answer sheet.)

ANS: 2, 3, 1, 4 PTS: 1 DIF: Easy OBJ: Section 4.1  
LOC: 20–D1.4k TOP: Energy & matter exchange by Human organism KEY: Digestive system  
MSC: Knowledge

6. Breathing or pulmonary ventilation occurs in two stages: inhalation and exhalation. Some of the steps occurring during our body's breathing mechanism are given below.

1. Volume of chest cavity is reduced
2. Muscles of diaphragm relax
3. Negative air pressure is created inside lungs
4. Muscles of the diaphragm contract.

The order, in which the events listed above occur during breathing, if inhalation is followed by exhalation, is \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.

(Record all four digits of your answer in the numerical-response section on the answer sheet.)

ANS: 4, 3, 2, 1

During inhalation, the rib muscles and diaphragm contract. This is followed by an increase in volume of the chest cavity. This creates a negative air pressure inside the lungs and pulls the environmental air through the nostrils. During exhalation, the rib muscles and diaphragm relax and thus the volume of chest cavity gets reduced. The air present in lungs is thus forced out.

PTS: 1                      DIF: Easy                      OBJ: Section 4.1  
LOC: 20–D1.5k      TOP: Energy & matter exchange by Human organism      KEY: Respiratory system  
MSC: Knowledge

7. The human body's defense system protects the body against the attack of pathogens either by preventing their entry or destroying them after their entry. Description of various components of the human body's defense system is given below.

1. Largest barrier of the body
2. It is among the first line of defense
3. Phagocytic nature protects the body from bacteria
4. Contains monocytes and lymphocytes

Using the numbers above, match the above mentioned steps of digestive system with the organs where they occur.

Description:

Components of  
defense system:

Eye lids      Lymph glands      Neutrophils      Skin

(Record all four digits of your answer in the numerical-response section on the answer sheet.)

ANS: 2, 4, 3, 1      PTS: 1      DIF: Easy      OBJ: Section 4.2  
LOC: 20–D2.8k      TOP: Energy & matter exchange by Human organism  
KEY: Immune system, Defense system  
MSC: Knowledge

8. The excretory system regulates the volume and composition of body fluids by removing wastes and returning useful substances to the body. Some of the organs of the excretory system and their characteristics are given below.

1. Carry urine to the bladder
2. Stores urine
3. Eliminates urine from the body
4. Composed of nephrons

Match the characteristics of the excretory system with the correct organ.

Characteristics: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.

Organs: Urinary bladder Ureter Kidney Urethra

ANS: 2, 1, 4, 3 PTS: 1 DIF: Easy OBJ: Section 4.3

LOC: 20–D3.1k TOP: Energy & matter exchange, human organism KEY: Excretory system

MSC: Knowledge

9. Energy is generated, during the light dependent reaction of photosynthesis, by chemiosmosis. During the light dependent reaction, the splitting of water occurs, which releases two electrons. These electrons pass through various steps, which are as follows:

1. Electrons are accepted by primary electron acceptor
2. Electrons enter photosystem I
3. Electrons enter photosystem II
4. Electrons pass through the Electron transport chain

The order, in which the events listed above occur, during the light dependent reaction of photosynthesis, is \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.

(Record all four digits of your answer in the numerical-response section on the answer sheet.)

ANS: 3, 1, 4, 2

During the light dependent reaction of photosynthesis, the splitting of water releases electrons that replace the electron of P680, which is the reaction center of photosystem II. Now the electron passes through the electron transport chain and enters the photosystem I.

PTS: 1 DIF: Easy OBJ: Section 3.1

LOC: 20–C1.1k TOP: Energy & matter exchange in ecosystem KEY: Pigments, absorption of light by chlorophyll

MSC: Knowledge

10. The process of chemiosmosis results in the generation of ATP. Some of the events occurring during this process are listed below.

1. Protons move into the matrix
2. Protons move across the inner mitochondrial membrane
3. ADP combines with inorganic phosphate
4. Electrons enter the electron transport chain

The order, in which the events listed above occur, during the process of chemiosmosis in mitochondria, is \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.

(Record all four digits of your answer in the numerical-response section on the answer sheet.)

ANS: 4, 2, 1, 3      PTS: 1      DIF: Easy      OBJ: Section 3.2  
LOC: 20–C2.2k      TOP: Energy & matter exchange in ecosystem      KEY: Chemiosmosis  
MSC: Knowledge

11. The human circulatory system includes the heart, the blood and the blood vessels. Some of the structures involved with the circulation of blood are listed below

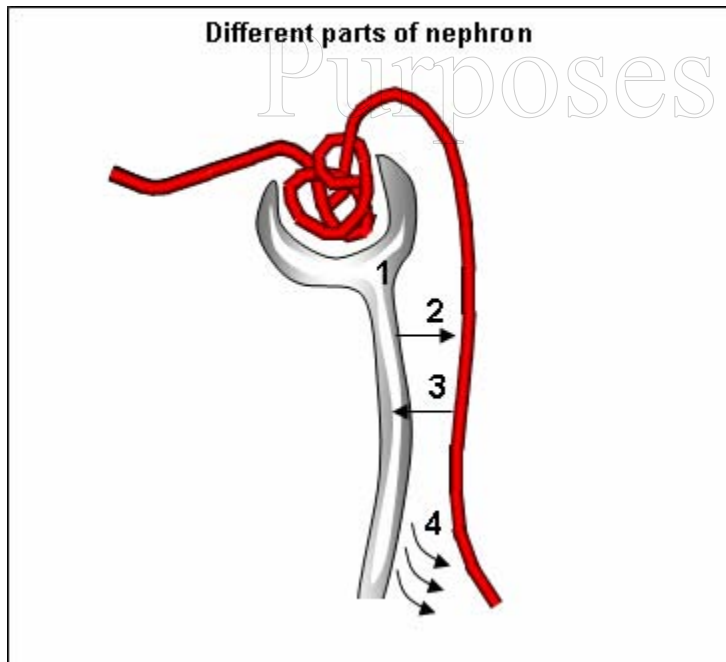
1. Arteries
2. Atria
3. Ventricles
4. Veins

The order that blood entering the heart would pass through these structures is \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.

(Record all four digits of your answer in the numerical-response section on the answer sheet.)

ANS: 4, 3, 2 and 1      PTS: 1      DIF: Easy      OBJ: Section 4.2  
LOC: 20–D2.1k      TOP: Energy & matter exchange by Human organism      KEY: Circulatory system  
MSC: Knowledge

12. Use the following information to answer the next question.



Urine formation occurs in the nephrons. The four major processes occurring during urine formation are listed below.

1. Tubular secretion
2. Tubular reabsorption
3. Water reabsorption
4. Glomerular filtration

The correct order for the formation of urine is \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.  
(Record all four digits of your answer in the numerical-response section on the answer sheet.)

ANS: 4, 2, 1 and 3

PTS: 1

DIF: Easy

OBJ: Section 4.3

LOC: 20–D3.2k

TOP: Energy & matter exchange, human organism

KEY: Excretory system

MSC: Knowledge

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For Evaluation  
Purposes Only

## WRITTEN RESPONSE

1. Use the following information to answer the next question.

A biome has a particular mix of plants, animals and other organisms that are adapted to living under certain environmental conditions. Six major biomes of the world are freshwater, marine, desert, forest, grassland and tundra. Consider the following biomes.

### **Biome 1: Tropical rainforest**

The tropical rainforests are the best developed in the jungles of South and Central America. The vegetation of tropical rainforests is characterized by dense, tall trees that leave very little space for sunlight to reach the forest floor. The branches of the evergreen trees are characterized by epiphytes. The high rainfall at the tropical rainforests leaches the soil and the humus content of the soil is also less. That is why tropical rainforests are not suitable for growing crops.

### **Biome 2: Desert**

Deserts are characterized by very little rainfall. Plants here, like mesquite, cacti etc. are adapted towards conserving water. Snakes and lizards can be commonly seen in all deserts.

### **Biome 3: Grassland**

Grassland can be a tropical biome like Savanna, or a temperate biome like prairie. The grasses present in this type of biome are adapted to irregularly changing periods of rainfall and dryness. In comparison to other biomes, the grassland biome is thought to be supporting the maximum species of animals.

- (a) Compare the productivity of tropical rainforest with that of desert.
- (b) During the season for growth, which of the two ecosystems, the grassland or the tropical rainforest, will have lesser productivity, and why?
- (c) State two factors on which the productivity of an ecosystem depends.

ANS: (a) Productivity is the rate at which an ecosystem's producers capture and store energy in organic compounds, over a certain length of time. The number of producers in the desert is very less in comparison to that of the tropical rainforest. Thus the productivity of tropical rainforest is more than that of desert.

(b) Productivity is the rate at which the organisms produce new biomass. It is not the total mass of producers in the ecosystem. During the season for growth, the productivity of grassland will be more than that of the tropical rainforest. This is because the animals in the grassland constantly keep on eating the plants and new biomass is constantly being produced.

(c) Two factors on which the productivity of an ecosystem depends are solar radiation and the amount of moisture available. Besides these, there are other factors, such as the available nutrients, that influence the productivity of an ecosystem. Explain your choices.

PTS: 10

DIF: Easy

OBJ: Section 1.3

LOC: 20–A3.1k

TOP: Biosphere

KEY: Ecosystem, Productivity

MSC: Knowledge

2. Use the following information to answer the next question.

There are two mechanisms that generate energy in the form of ATP: substrate-level phosphorylation and chemiosmosis. The substrate-level phosphorylation uses the enzyme substrate complex model for ATP synthesis. The other method follows the chemiosmotic theory for ATP production. The chemiosmotic theory was proposed by Peter D Mitchell in 1961. The process of chemiosmosis occurs in mitochondria, chloroplast and in a few bacteria as well.

(a) During chemiosmosis, ATP is generated in mitochondria, by the movement of ions across the membrane. What is the name of this ion?

(b) What is the role of ATP synthase in chemiosmosis?

(c) Compare the three stages of cellular respiration (starting and finishing compounds, amount of energy produced, and location in the cell where each occurs).

ANS: (a) ATP is generated, during chemiosmosis, by the movement of hydrogen ions across a membrane.

(b) ATP synthase is an enzyme that helps in the synthesis of ATP during chemiosmosis. The chemical reaction of ATP generation can be represented as follows:  $ADP + P_1 \rightarrow ATP$ . ATP synthase helps protons to move back across inner membrane of mitochondria.

(c) *Answer to come.*

PTS: 10

DIF: Easy

OBJ: Section 3.2

LOC: 20–C2.2k

TOP: Energy & matter exchange in ecosystem

KEY: Chemiosmosis

MSC: Knowledge

3. Use the following information to answer the next question.

The circulatory system of human beings consists of heart, blood and blood vessels. Human beings have a four-chambered heart, which is divided into two upper atria and two lower ventricles. Two veins empty blood to the right atrium of the heart. They are the superior vena cava and inferior vena cava. The right side of the heart is involved in pulmonary circulation and the left side of the heart is involved in systemic circulation.

- (a) How is the superior vena cava functionally different from the inferior vena cava?
- (b) Compare pulmonary circulation with the systemic circulation.
- (c) Why is it important that a patient have a leaky heart valve replaced?

ANS: (a) The superior vena cava carries blood from the upper half of the body to the heart and the inferior vena cava carries blood from the lower half of the body to the heart.

(b) The right side of the heart carries deoxygenated blood away from the heart and brings back oxygenated blood back to the heart. This is pulmonary circulation of blood. During the systemic circulation, the left side of the heart carries oxygenated blood away from the heart and brings back deoxygenated blood back to the heart.

(c) *Answer to come.*

PTS: 10

DIF: Easy

OBJ: Section 4.2

LOC: 20–D2.2k

TOP: Energy & matter exchange by Human organism

KEY: Circulatory system

MSC: Knowledge

DRAFT

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Purposes Only