Science Practice Test 7
"More Practice" Answer Key

1. **B**
In the given problem, it is stated that right-handedness is dominant. We can give a representation of this as R.

RR, Rr - right handed
rr - left handed

Since it is also stated that the mother and daughter are left-handed (rr), we can conclude the father has a genotype of Rr because at least one of the gene of the parents should be inherited by the offspring.

2. **A**
Let a be gene for disease

Having a carrier parent means that the genotype is heterozygous (Aa) since the individual carries the gene but does not show disease symptoms. This means that the disease is recessive and the only time an individual will show symptoms of the disease is if the genotype is homozygous recessive (aa).

Aa (carrier parent) x AA (not a carrier parent)

	A	a
A	AA	Aa
A	AA	Aa

Since none of the offspring show a homozygous recessive genotype, none of the offspring will show symptoms of the disease.

3. **B**
Proteins are the most abundant organic molecule in the cell. They have diverse functions for structural support, transport, storage, and defense. Proteins also serve as enzymes to catalyze chemical reactions in the cell.

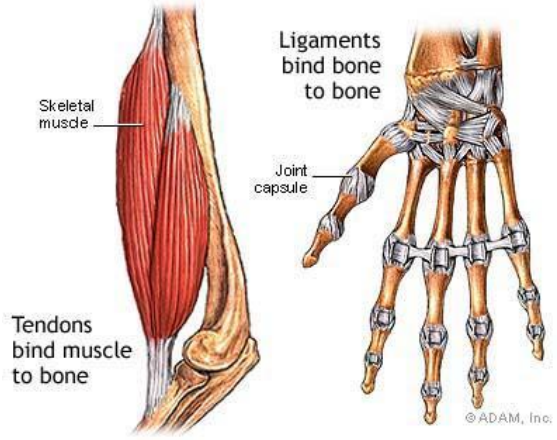
4. **D**
Alexander Fleming discovered Penicillin–a toxin produced by fungi from *Penicillium* species. Penicillin kills bacteria by damaging the bacterial cell wall. It serves as an antibiotic drug to treat a wide range of bacterial infections, including strep throat, pneumonia, and certain urinary tract infections.

5. **B**
The organism shown in the figure is a planarian. Since it has a simple body plan, then it can regenerate a complete body from fragments of itself through regeneration.

6. **D**
If the tibial nerve (which is a motor and sensory nerve) is blocked, then areas below the obstruction (such as toes) cannot move nor feel.

7. **B**
Cardiac and smooth muscles are involuntary. These muscles are usually found in organs. Conversely, skeletal muscles are voluntary. This means that it is usually under conscious control. Contractions of these muscles cause bones and cartilages to move. Biceps are among the skeletal muscles.

8. **B**



Source:http://www.nytimes.com/imagepages/2007/08/01/health/adam/19089Tendonvsligament.html

9. **A**
The class Crustacea which is under the phylum Arthropoda consists mainly of aquatic arthropod invertebrates. Crustaceans have a hard external skeleton, segmented body, several pairs of jointed legs, antennae and eyes. Lobsters, crabs, shrimp, crayfish and barnacles are examples of crustaceans.

10. **D**
A shark is a cartilaginous fish while a sea horse is a bony fish. Despite this, both of them have segmented spinal columns. A tadpole is the larva of a frog. An adult frog has 10 vertebrae. Octopuses, on the other hand, do not have vertebrae. They move through jet propulsion and walk with their highly flexible tentacles.

11. **A**
The phylum Cnidaria consists of invertebrate ocean animals characterized with tentacles that surround the mouth. Examples of cnidarians are sea anemones, corals and jellyfish.

12. **A**
Yeast is a small unicellular fungus that is used to ferment sugars and other carbohydrates.

13. **D**
Echinodermata is a phylum which consists of animals which usually have a five-part radial symmetry and are equipped with tube feet, such as starfish, brittle stars, sand dollars, sea cucumbers and sea urchins.

14. **B**
All insects have 6 legs. Since ants, beetles and butterflies have 6 legs, they can be classified as insects. A tick has 8 legs and is thus an arachnid.

15. **A**

Scientific Name	**Common Name**
Chanos chanos	milk fish (bangus)
Musa squamosa	*Musa* is the genus that comprise of bananas and plantains.
Pterocarpus indicus	Narra
Livistona rotundifolia	Anahaw

16. **B**
Peas are round green seeds that grow in a pod. A seed is a plant part that contains embryo. Thus, it is produced by the fertilization of ovule. Usually, the ovule is enclosed within the ovary. The ovary turns into an outer covering after fertilization of the ovule.

17. **C**
The process in which water is released from the roots to the small spores on the underside of leaves of plants is called **transpiration**.

There are several factors that affect transpiration such as temperature, relative humidity, wind and air movement, soil-moisture availability and type of plant.
Higher temperatures cause stoma to open, increasing the rate of transpiration, whereas colder temperatures cause stoma to close, decreasing the rate of transpiration.

As the relative humidity increases, the rate of transpiration decreases since it is difficult for water to turn into vapor when air is more saturated.

18. **B**
When you exercise, the body uses more glucose which is then converted in the body into energy (ATP) via cellular respiration. Oxygen is required for aerobic respiration of cells in the body. This causes rapid breathing to increase oxygen intake in the body. The heart rate also rises as the heart pumps more blood to deliver oxygen to muscle cells. To increase blood flow, **arteries dilate** rather than constrict.

Science Practice Test 8
"More Practice" Answer Key

1. **D**

The three domains are Domain Archaea, Bacteria, and Eukaryota. The only two prokaryotic kingdoms are Archaebacteria and Eubacteria. The remaining kingdoms under Domain Eukarya are all eukaryotes including Kingdom Protista, Plantae, Animalia, and Fungi.

2. **B**

Kingdom	w/cell wall	w/mito-chondria	w/nuc-leus	w/ribo -somes
Prokaryotes				
Archae-bacteria	most	no	no	yes
Eu-bacteria				
Eukaryotes				
Protista	some	yes	yes	yes
Fungi	yes			
Plantae	yes			
Animalia	no			

Only organisms of the Kingdoms Fungi and Plantae possess these characteristics.

3. **C**

Most prokaryotic cells have a cell wall which protects the cell and gives it shape. Examples of prokaryotes without a cell wall include bacteria from mycoplasma group.

Although some eukaryotic cells such as plants and some fungi have cell walls, most eukaryotic cells do not possess a cell wall. Animals have a cell membrane which consists of a lipid bilayer. Selected particles can diffuse through this membrane.

4. **B**

The only 2 kingdoms that consist of all prokaryotic (or simple, single-celled) organisms are Kingdom Eubacteria from Domain Bacteria and Kingdom Archaebacteria from domain Archaea.

5. **B**

Type A blood (according to the A-B-O blood type classification system) has two possible genotypes namely ***AA*** or ***AO***. On the other hand, type O blood has only one possible genotype namely ***OO***. Also, an offspring will get one allele from each parent.

AA x OO			**AO x OO**		
	O	O		O	O
A	**AO**	**AO**	A	**AO**	**AO**
A	**AO**	**AO**	O	**OO**	**OO**

As shown by the chart, a cross between a woman with blood type A and a man with blood type O can only produce genotypes ***AO*** or ***OO*** and thus blood types A or O. Therefore, it is impossible that her dad is her real dad because she cannot inherit a ***B*** allele from her father.

6. **B**

If a woman has blood type O, then her genotype is ***OO***. If her husband's blood type is B and her father-in-law has blood type O, then her husband's genotype is ***BO*** (Her husband must have at least one ***O*** allele inherited the father).

As shown as the chart below, a cross between parents with genotypes ***BO*** and ***OO***, will result into a offspring with a phenotypic ratio of 1 ***OO*** : 1 ***BO***. Thus, there is $\frac{1}{2}$ or 50% chance of getting an offspring with a blood type of B.

OO x BO		
	B	O
O	**BO**	**OO**
O	**BO**	**OO**

7. **D**

Blood Type	
Phenotype	Genotype
Type A	AA and AO
Type B	BB and BO
Type AB	AB
Type O	00

Multiple Alleles
Cross: AB x AO

	A	B
A	AA	AB
O	AO	BO

Genotypic ratio: 1:1:1:1
(AA =25% AB=25% AO=25% BO=25%)

Phenotypic ratio: 1:1:1:1
(Type A =50% Type AB =25% Type B =25%

Blood type O can only be possible if there is a genotype of OO.

8. **B**

If ***B*** denotes the allele for black fur coat and ***b*** denotes the allele for brown fur coat, then a black dog or bitch must have a genotype ***BB*** or ***Bb***.

Given that they had brown puppies, then each parent should have an allele for brown fur coat. Thus, both parents have the genotype ***Bb***.

The cross between parents with genotype ***Bb*** produced 6 black puppies and 2 brown puppies. This is in the ratio 3:1. This follows the trend in the F2 generation of Mendel's experiment. Thus we can say that it followed the Mendelian Mode of Inheritance wherein black is the dominant trait and brown is the recessive trait.

9. **C**

Since both parent rats had brown eyes, but produced baby rats with red eyes, this means that the allele for the red eyes is a recessive trait and both parents had the Bb genotype. The babies with red eyes have the bb genotype. Thus, brown eyes are dominant while red eyes are recessive.

10. **D**

A phenotypic ratio of 75:25 or simply 3:1 usually comes from parents which both have heterozygous genes. Therefore, the genotypes of the parents are Bb and Bb.

11. **A**

Both prokaryotic and eukaryotic cells contain plasma membrane, genetic material, cell membrane, and ribosomes. Nucleus is a membrane-bound organelle containing the genetic material only found in eukaryotes. Prokaryotes do not have nucleus since their genetic material is suspended in the cell found in the nucleoid region.

12. **D**

The ability to reproduce is a common characteristic of all living organisms regardless of the kingdom. The table below compares the different characteristics of plants, animals and fungi.

Characteristic	**Kingdom**		
	Plantae	**Animalia**	**Fungi**
Cell wall	Yes (cellulose)	no	Yes (chitin)
Mode of nutrition	autotroph	heterotroph	heterotroph
Unique features	Chloroplast & thylakoid for photo-synthesis	centrioles	hyphae

Science Practice Test 9
"More Practice" Answer Key

1. **C**
A cladogram is a diagram which presents evolutionary relationships. **Cuticle** is a waxy covering on leaves that prevents plants from being dehydrated. The presence of cuticles is a distinguishing feature between plants and green algae since all plants have cuticles while green algae do not. *Bryophytes* are the **most primitive type** of plants since they are the first to evolve a cuticle.

After cuticle, plants evolved **vascular tissue** consisting of xylem and phloem. These are complex tissues which function for transportation of water, nutrients, and food. Pteridophytes including ferns and horsetails are the first to develop vascular tissues.

The next evolutionary event is the development of **seeds**. The first group to develop seeds are gymnosperms such as pine trees and cycads. Finally, plants evolved **flowers and fruits**. These flowering plants are called angiosperms.

2. **A**
We can see in the given cladogram that birds and Saurischian dinosaurs have four common characteristics while birds and Ornithischian dinosaurs have two common characteristics. The two types of dinosaurs share only one common characteristic with humans and do not share any characteristic with other animals. Thus, we can say that the dinosaurs are most closely related to birds.

3. **A**
When we look at the diagram, we can see that frogs, humans and whales split from crocodiles, birds, Saurischian dinosaurs and Ornithischian dinosaurs. Thus, we can say that animals from different groups are distantly related and that common characteristics in the two groups are developed independently of each other.

4. **A**
The Paleozoic era is the oldest and the Cenozoic era is the newest. Thus, the organisms that evolved the most recently are in the group with a starting point that is nearest to the Cenozoic era, which are the Chordates.

5. **C**
An increase in the population of a group is symbolized by an outward sloping of the graph. Thus, arthropods had the greatest increase during the Cenozoic era.

6. **B**
The only group that became extinct before the Cenozoic era is the Graptolites. Graptolites became extinct specifically during the Permian period.

7. **C**
Extinction of dinosaurs cannot be caused by human disturbance since the dinosaurs became extinct at the end of the Cretaceous era (85 million years ago), while archaic *Homo sapiens* between 400,000 to 250,000 years ago in the Cenozoic era.

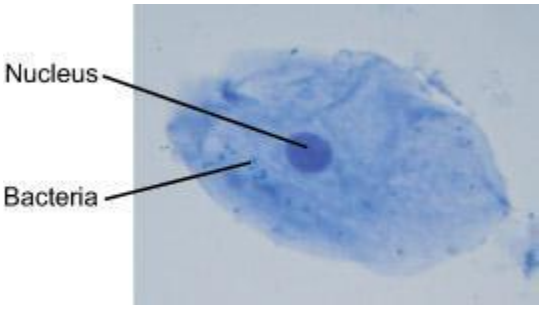
8. D
Osmosis occurs when water moves across a *semi-permeable membrane* from an **area of lower solute** concentration to an **area of higher solute concentration**. Basically, the movement of water is **towards the area with higher solute concentration.** Since glucose is too big to pass through the cell membrane of the red blood cell, only water can enter the cell to allow equilibrium.

In an isotonic solution, the solute concentration is equal inside and outside the cell, so there is no net movement of water.

In a hypotonic solution, the solute concentration inside the cell is higher so water will move towards the cell.

In a hypertonic solution, the solute concentration outside the cell is higher so water will move outside the cell. This will cause the red blood cell to shrink as water leaves the cell.

9. **C**



Source:https://www2.mrc-lmb.cam.ac.uk/microscopes4schools/media/cheekcell.jpg

The cells seen are squamous **epithelial cells** from the outer epithelial layer of the mouth. The small blue dots are bacteria from our teeth and mouth.

10. **C**

Among the options, only the cladogram in option C correctly shows that primates and rabbits have hair but no eggs w/shells while crocodiles and birds have eggs w/shells but no hair.

11. **C**

a. Both amphibians and birds share a common ancestor but birds did not evolve directly from birds
b. Amphibians are the least primitive among the listed vertebrates
c. Both crocodiles and birds share the characteristics of having hair but not having eggs w/shells. Meanwhile, amphibians have neither hair nor eggs w/shells. Thus, crocodiles are more closely related to birds than amphibians as they share more characteristics.
d. The first group to diverge from the common ancestor is the amphibians.

12. **B**

The factors affecting osmosis are temperature, concentration gradient.

Higher temperature increases the average kinetic energy making water molecules move faster. Thus, higher temperature allows faster rate of osmosis.

Similarly, a larger concentration gradient (a greater difference in solute concentration across the membranes) indicates high osmotic pressure causing faster osmosis.

Science Practice Test 10
"More Practice" Answer Key

1. **D**

If an organism has adapted well to its environment, it has a survival advantage and is thus less likely to become extinct. Also, mutations are less likely to occur within organisms of this kind since mutations usually occur in direct response to selective pressure to increase the chances of survival. Likewise, if an organism has already adapted well to its environment, then it will stay there **and prevent migration.** In addition, the adaptation of an organism to its environment is a good trait and will probably be passed on to its offspring.

2. **B**

If *X* denotes the dominant allele for free earlobes and *x* denotes the recessive allele for attached earlobes, then the result of a cross between a heterozygous man and a woman with attached earlobes (homozygous recessive or *xx*) is

	x	x
X	Xx	Xx
x	xx	xx

Thus, the offspring has 2 out of 4 or a 50% chance of having free earlobes.

3. **A.**

During translation, transcribed mRNA binds to the ribosome. Complementary transfer RNAs with bound amino acids attach to the E, P and A sites of the ribosome. The mRNA passes along the ribosome in surges of 3 nucleotides.

(Partner bases: Adenine and Uracil; Cytosine and Guanine)

mRNA codon sequence	U – A – G
tRNA codon sequence	A – U – C

4. **A**

Replication is the process of duplicating DNA to create more copies of genetic material. It is needed for cell growth and repair of damaged cells.

During replication, adenine pairs with thymine while guanine pairs up with cytosine.

Template Strand: 3' ATTAGAA 5'
New Strand: 5' TAATCTT 3'

5. **D**

Transcription is the synthesis of a complementary RNA copy from a DNA segment. Thus, the RNA consists of the 'partner' bases of the ones in DNA and that uracil is used in place of thymine. (Partner bases: Adenine and Thymine/Uracil; Cytosine and Guanine)

Before: 3' ATGCGTACG 5'
After: 5' UACGCAUGC 3'

6. C

In transcription, the mRNA produced from the DNA strand should have a 5' to 3' direction. The nucleotide bases of the RNA should also be adenine (A), uracil (U), guanine (G), and cytosine (C), wherein A is paired to U and G is paired to C. Since the given sequence is 3' CGATGCACCC 5', the mRNA strand should be:
5' GCUACGUGGG 3'

7. **D**

It was observed in Mendel's dihybrid crosses that characteristics were inherited as separate units and that each unit was inherited independently of the others.

8. B

Different organisms require different oxygen levels for survival.

Set-up A contains anaerobic bacteria which can only grow in the absence of oxygen.

Set-up B contains obligate aerobe bacteria which can only survive in the presence of oxygen.

In setup C, there is equal growth of bacteria regardless of whether oxygen is present or not.

For Setup d, the bacteria can grow in both aerobic and anaerobic conditions but there is more growth when there is a high level of oxygen.

9. **A**

Chargaff's rule states that the "total number of purine bases equals the total number of pyrimidine bases". Purine bases include adenine (A) and guanine (G) while p**y**rimidine include c**y**tosine (C) and th**y**mine (T).

Since adenine pairs up with thymine, the number of adenine bases equals the number of thymine. The same is true for cytosine and guanine.

%Adenine= %Thymine
%Guanine= % Cytosine

Since it is a given that 20% of the bases consist of adenine, this means that the percentage of thymine is also 20%. The total of **adenine and thymine is 40%** which means that the total of **guanine and cytosine is 60%** to make the total percentage equal to 100%

Since the number of guanine and cytosine are equal, each is 30%.

10. C

Some animals in a desert environment can tolerate a high-salt diet to broaden their source of water. Others conserve water by **minimizing sweating and urine production**. Some desert animals also conserve energy during the day which leads to reduced heart rate and respiration.

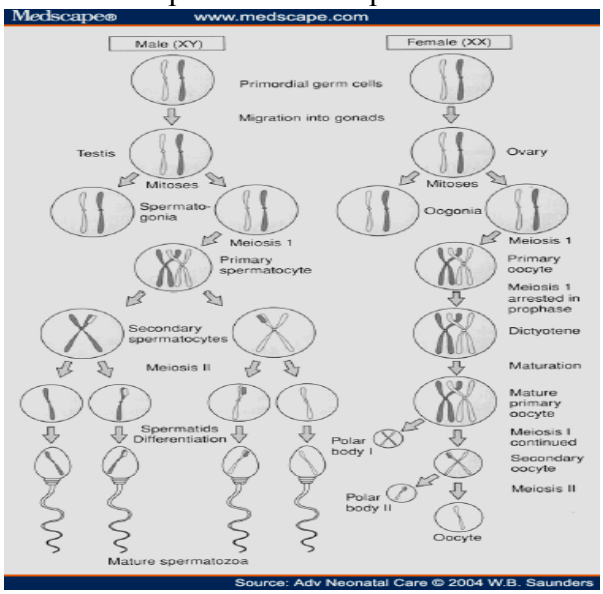
Science Practice Test 11
"More Practice" Answer Key

1. **D**
One spermatogonium produces 4 sperm cells through meiosis while one oogonium produces 1 egg cell and 3 polar bodies through meiosis.

2. **B**
Given that the allele for long antennae is denoted as ***L***, we can assume that the allele for short antennae is denoted as ***l***. If all the offspring have long antennae, then their possible genotypes are ***LL*** or ***Ll***. However, since their mother has short antennae and a genotype ***ll***, the offspring must have at least one ***l*** allele. Thus, their genotype is ***Ll***.

3. **C**
Oogenesis: oogonium (diploid) → primary oocyte (diploid) → secondary oocyte (haploid) and polar bodies → 1 egg and 1 polar body (from secondary oocyte) and 2 polar bodies

4. **A**
Spermatogenesis: spermatogonium (diploid) → primary spermatocyte → 2 secondary spermatocytes (haploid) → 4 spermatids → 4 spermatozoons/sperms



5. **B**
When the first sperm membrane fuses with the egg membrane, it separates the fertilization membrane and forms a barrier to other sperm. Then, both the egg and the sperm form a nucleus within the egg. They each contain half of the chromosomes that the embryo will have.

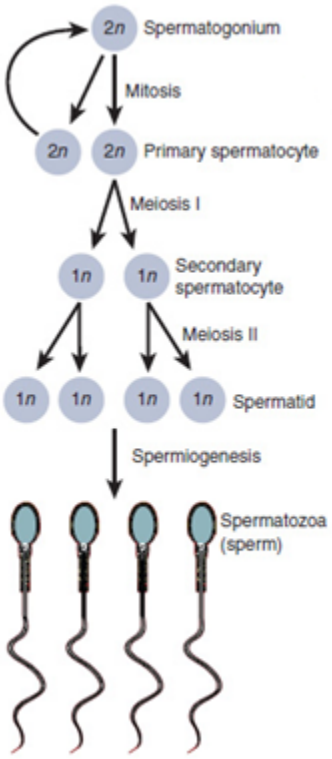
Source:http://www.austinivf.com/embryology/egg-oocyte-fertilization.php

6. **C**
The fertilized egg of an organism with 64 chromosomes undergoes meiosis and yields one egg cell and three polar bodies will have the same number of chromosomes because of fertilization.

7. **B**
Organism A and B exhibit competition while Organism C exhibits coprophagia.

Coprophagia is the consumption of feces. Organism C could be a domestic dog or a dung beetle.

8. **B**
Gametogenesis is the process whereby a haploid cell (n) is formed from a diploid cell (2n) through meiosis and cell differentiation. Gametogenesis in the male is known as **spermatogenesis** and produces spermatozoa. Gametogenesis in the female is known as **oogenesis** and result in the formation of ova.



Source:http://s3.amazonaws.com/teachmeseries/tmphysiology/wp-content/uploads/2017/07/22091127/Spermatogenesis-1.png

Spermatogenesis: spermatogonium (diploid) → primary spermatocyte → 2 secondary spermatocytes (haploid) → 4 spermatids → 4 spermatozoons/sperms

Science Practice Test 12
"More Practice" Answer Key

1. **C**

Females have two X sex chromosomes (XX) while males have one X and one Y sex chromosomes (XY). Since only males have Y chromosomes, Y-linked inheritance occurs when a trait or disorder caused by a gene on the Y chromosome is passed from an affected father to all of his sons. Daughters do not inherit the Y chromosome, so they are not affected and do not pass on the trait.

2. **C**

Blood type O is a recessive trait. This means that an individual will only have this blood type if the genotype is homozygous with two O alleles (OO).

A woman with blood type AB has a genotype of AB while a man with blood type A has the genotype of either AA or AO. Since blood type AB contains no O allele, it is impossible for parents with blood type A and blood type AB to have an offspring with a blood type O.

3. **A**

Let X^a be the allele for disease. For an X-linked recessive disease, the following are the possible genotype and corresponding phenotype.

Female:
X^AX^A - Normal
X^AX^a - carrier of the allele for disease but show no symptom of the disease
X^aX^a - with disease

Male:
X^AY - Normal
X^aY - with disease

For female, two X^a are needed to have the disease, while for male, only one X^a is needed to have the disease.

Crossing affected female (X^aX^a) with normal man (X^AY):

	X^A	Y
X^a	X^AX^a (carrier female)	X^aY (affected male)
X^a	X^AX^a (carrier female)	X^aY (affected male)

All males will have the disease while none of the females will have disease.

4. **D**

Hemophilia is another X-linked disease.
X^h- hemophilia

Crossing affected female (X^aX^a) with normal man (X^AY):

	X^H	Y
X^h	X^HX^h (carrier female)	X^hY (affected male)
X^h	X^HX^h (carrier female)	X^hY (affected male)

The possibility of their son to have hemophilia is 100%

5. **D**

Fungi were once classified under plants since both have cell walls; however, the two differ in classification. The plant cell wall is made up of cellulose while the fungi cell wall is made up of chitin.

6. **C**

An organism can be classified as a second order consumer if it eats a first order consumer or an herbivore. Since according to the food web, man eats chickens, which in turn, eats corn, then chickens can be classified as herbivores or first-order consumers and man can be classified as a second-order consumer.

7. A

The food chain starts with an organism that produces its own food from a primary energy source or autotrophic. Examples of these are plants and algae. Thus, the food chain must start with cabbage.

Next on the chain is a first-order consumer, an organism which eats autotrophic organisms. Since a snail is an herbivore, it should be next in this specific chain.

Rats on the other hand are omnivores. They eat either plants or animals. Specifically, they can eat snails. Even though rats could be next to cabbage in the food chain, snails cannot eat any organism in the chain aside from cabbage.

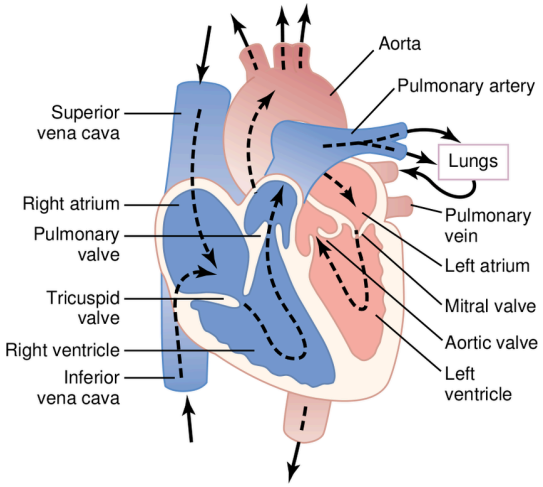
Molds are detritivores - organisms which break down dead plant and animal matter. Thus it must be last in this food chain.

8. **B**

Mutualism occurs when two different species both benefit when they are together, resulting in increased population together compared to when the two species are separated.

9. **B**

Refer to the figure below. Red is for oxygenated blood while blue is for deoxygenated blood.

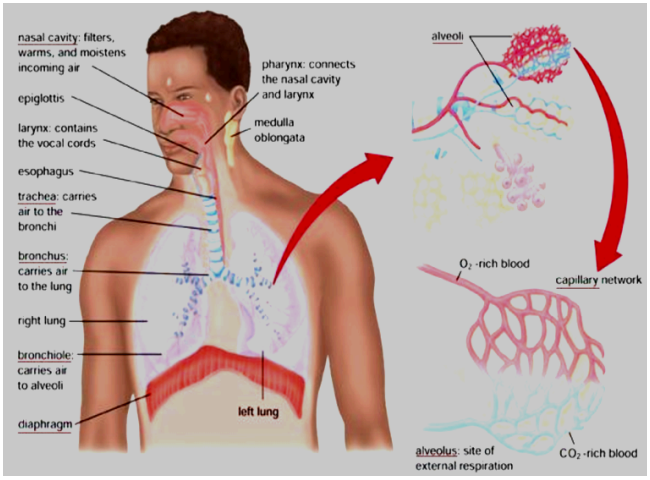


Source:https://www.researchgate.net/figure/Structure-of-the-heart-Blood-flow-through-the-chambers-and-heart-valves-Figure_fig1_327558169

10. **B**

During inhalation, air travels from one's nose or mouth to the alveoli where an O_2-CO_2 exchange occurs. Thus, air flows through the respiratory system as follows:

nasal cavity → pharynx →larynx → trachea → bronchus → bronchiole → alveoli



Source:http://www.docstoc.com/docs/88989762/Structure-and-Function-of-the-Respiratory-System

11. **D**

Enzyme	Place	Substrate	Products	Origin
Salivary amylase	Mouth	Starch, glycogen	Maltose	Salivary glands
Pepsin	Stomach	Protein	Peptides	Stomach glands
Lipase	Sm. Int.	Fats	Glycerol, fatty acids	Stomach glands
Pancreatic amylase	Sm. Int	Starch	Maltose	Pancreas
Pancreatic lipase	Sm. Int	Fats	Glycerol, fatty acids	Pancreas
Trypsin	Sm. Int	Peptides	Simpler peptides	Product of enzymes from pancreas and duodenum
Maltase	Sm. Int	Maltose	Two glucose molecules	Glands in wall of small int.

Source:http://www.docstoc.com/docs/42151762/DIGESTIVE-ENZYMES-WORKSHEET-ANSWERS

Before small intestine digests absorbs the simplest forms of organic matter, food must first be digested in the mouth, esophagus, stomach and the small intestine with the help of enzymes. Thus, food must first be broken down into maltose, peptides / simpler peptides (amino acids), glycerol and fatty acids.

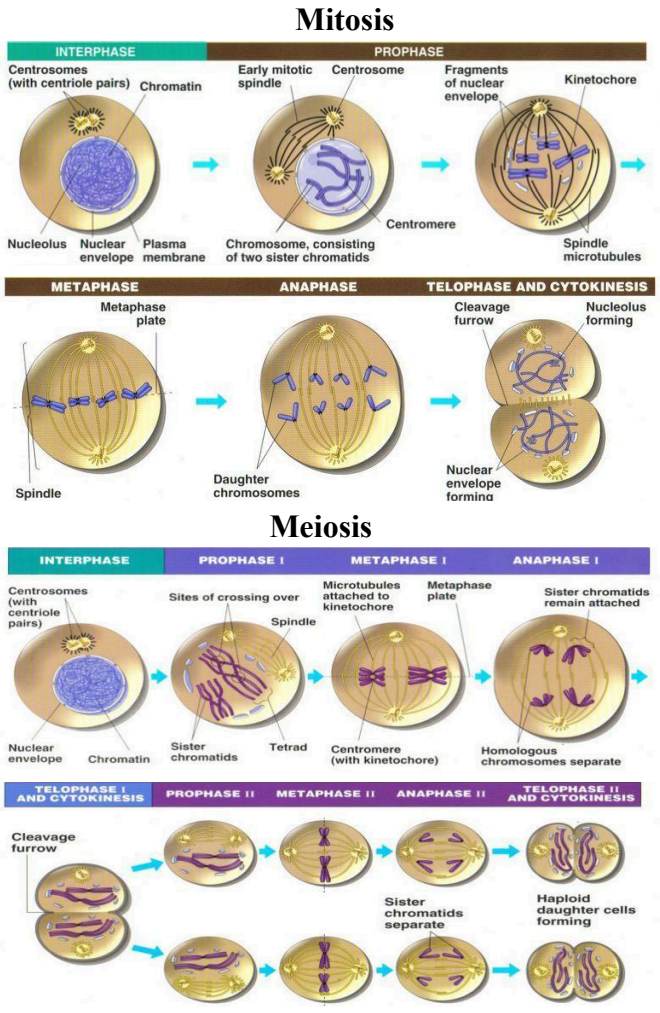
12. **B**

Meiosis is a process of cell division that occurs in sex cells/gametes during which the nucleus divides into four nuclei wherein each contains half the chromosomal number of a usual nucleus.

13. **B**

Mitosis is the process wherein a cell divides into two daughter cells, each of which has the same number of chromosomes as the parent cell. This process occurs in somatic or body cells for the repair and growth. However, sex cells or gametes are formed by meiosis. In meiosis, the daughter cells have half the number of chromosomes of the parent cell.

14. **A**



In the diagram, we can see that chromosomes, centrioles and the mitotic spindle participate in cell reproduction. During prophase, centrioles move to the opposite poles of the cell and form the mitotic spindle, which in turn, pull the chromosomes apart during anaphase.

15. **D**

The primary spermatocyte/oocyte (2n) undergoes meiosis resulting in the haploid (n) secondary spermatocyte/oocyte .

Spermatogenesis produces 4 sperm cells from each primary spermatocyte while oogenesis produces 1 egg cell and 3 polar bodies from each primary oocyte.

16. **A**

Eukaryotes have a nuclear membrane while prokaryotes do not. Thus, *Lactobacillus* cannot be the answer since it is a prokaryote. Amoebas do not have a cell wall while green algae has chloroplast as it is photosynthetic. Thus, by eliminating other choices, the only possible answer is yeast.

Yeast is classified under kingdom Fungi. It is eukaryotic and heterotrophic with a cell wall composed of chitin.

17. **D**

Amoeba does not have cell walls, only cell membranes. Green Alga have chloroplasts. Molds have no flagellum. This leaves Lactobacillus. Lactobacilli are rod-shaped, Gram-positive, fermentative, organotrophs. They are usually straight, although they can form spiral or coccobacillary forms under certain conditions. They are often found in pairs or chains of varying length. Lactobacilli are classified as lactic acid bacteria, and derive almost all of their energy from the conversion of glucose to lactate during homolactic fermentation. In this process 85 -90% of the sugar utilized is converted to lactic acid. They generate ATP by nonoxidative substrate-level phosphorylation.

18. **D**

Molds and amoeba do not have chloroplasts. Euglena does not have cell walls. This leaves Green Alga. Green algae have chloroplasts that contain chlorophyll a and chlorophyll b, giving

them a bright green color, as well as the accessory pigments beta carotene and xanthophylls, in stacked thylakoids. The cell walls of green algae usually contain cellulose and they store carbohydrate in the form of starch. All green algae have mitochondria with flat cristae. When present, paired flagella are used to move the cell. They are anchored by a cross-shaped system of microtubules and fibrous strands. Flagella are only present in the motile male gametes of charophytes and are absent from the gametes of Pinophyta and flowering plants.

19. **D**

Gel electrophoresis is used for separation of DNA, RNA, and proteins fragments from one another, for determination of DNA profile and for decomposition of molecules into cations and anions.

20. **C**

Viruses are not made out of cells, they can't keep themselves in a stable state, they don't grow, and they can't make their own energy. They need a living host to reproduce. Even though they definitely replicate and adapt to their environment, viruses are more like androids than real living organisms.

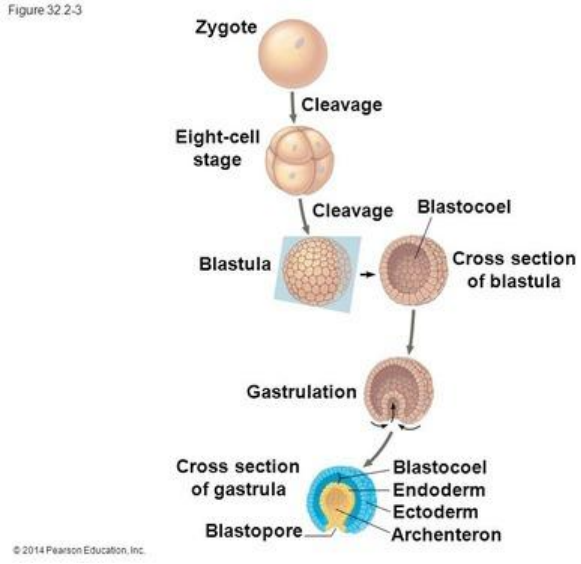
Source:https://www.khanacademy.org/test-prep/mcat/cells/viruses/a/are-viruses-dead-or-alive

21. **B**

Seaweed are primary producers in the marine ecosystem. Sea urchins feed on seaweed so an increase in the sea urchin population leads to a decrease in the seaweed population. Meanwhile, mollusks can inhibit the population of sea urchins either due to competition for resources or predation. Thus an increase in mollusk population indirectly causes a decrease in seaweed population.

22. **A**

The figure below shows the early embryonic development starting from formation of zygote after fertilization. During gastrulation, three distinct layers are formed which are ectoderm, mesoderm, and endoderm.



The **ectoderm** forms the external layer like hair and skin as well as parts of nervous system including the brain and spinal cord.

The **mesoderm** forms muscles and bones, kidney, and parts of the circulatory system such as blood cells and blood vessels.

The **endoderm** forms the lining of the respiratory and digestive system as well as liver and pancreas.

Table 1. Germ layer derivatives

Ectoderm	Mesoderm	Endoderm
Brain Spinal cord Epidermis Hair Skin	Muscles Bones Heart Kidney Blood cells Blood vessels	Lining of respiratory & digestive tract Liver Pancreas

23. **C**
Epithelial tissue lines the internal and external surfaces of the body. It functions for protection, secretion, filtration, and absorption.

24. **B**
Dendrites function as **receivers** of signals from other neurons, while **axons transmit signals away** from the cell body. In muscles, axons transmit signals to muscle fibers, causing them to contract.

25. **C**
A **nephrocyte** is a cell of the kidney, while a **lymphocyte** is a type of white blood cell found mainly in the blood, lymph nodes, and other lymphatic tissues**.**

26. **C**
Some opportunistic pathogens such as *E. coli* and *Salmonella* sp. have sensors that detect hormones like cortisol, which are released when the host experiences stress. This enables the pathogens to infect hosts with weakened immune systems more easily.

27. **D**
For order of mitosis:
- **Prophase-** chromosomes condense and become visible
- **Metaphase**- chromosomes line up the **m**iddle of the cell
- **Anaphase-** sister chromatids separate and move **a**way to opposite poles of the cell
- **Telophase**- Nuclear membranes form around each set of chromosomes, resulting in two cells containing identical copies of the chromosome

28. **D**
Klinefelter syndrome is a genetic disorder caused by changes in genes or chromosomes. It is caused by an error during meiosis when sex chromosomes fail to separate properly. This results in a male having an extra X chromosome (XXY) instead of the typical XY.

29. **C**
Eye color is x-linked recessive.
Given that:
X^a- allele for white eye
X^A- allele for red eyes

Since the allele for white is recessive, there will only be a white-eyed *Drosophila* if the genotype for female is homozygous recessive X^aX^a while the genotype for male is X^aY.

Since the father has white eyes, this means that his genotype is X^aY. For 50% of the offsprings to have red eyes, the mother must have a genotype of X^AX^a. See punnet square below:

	X^a	Y
X^A	X^AX^a (red-eyed female)	X^AY (red-eyed male)
X^a	X^aX^a (white-eyed female)	X^aY (white-eyed male)

30. No answer
X^f- allele for fabry disease

Since Fabry disease is an X-linked recessive disease, an individual will only have this disease if the genotype for females is homozygous recessive X^fX^f while the genotype for male is X^fY.

Since the mother is a carrier, her genotype is X^FX^f. Even if the father is normal (X^AY), there is still a 25% chance that the offspring will have the disease. See table punnet square below:

	X^F	Y
X^F	X^FX^F (normal)	X^FY (normal)
X^f	X^FX^f (carrier)	X^fY (with disease)

31. **A**

The main advantage of the mammalian lungs compared to fish gills is that lungs can survive without water.

32. **C**

Antigens are any foreign substances such as proteins, lipids, viruses, and bacteria that can trigger an immune response. **Antibodies** are part of the body's immune system.

Upon recognition of a specific antigen (for example, a protein from bacteria), specific antibodies are released from plasma cells and bind to the antigen. This binding triggers an immune response from other immune cells, such as macrophages and neutrophils, to eliminate the pathogen.

33. **D**

Table 2. Classification of chicken

Kingdom	Animalia
Phuylum	Chordata
Class	Aves
Order	Galliformes
Family	Phasianidae
Genus	*Gallus*
Species	*Gallus gallus*