# MOCK UPCAT 3: ANSWER KEY WITH EXPLANATIONS

1. **B**
   Humidity is the amount of water vapor in air. The air can hold water vapor depends on its temperature. The higher the humidity, the air can contain more water vapor. Warm air can hold more moisture than cooler air. As humidity starts to rise, the sweat beading up on the skin can't evaporate and provide cooling relief. When the air contains much water vapor, the sweat can hardly evaporate making an individual feels sticky the whole day.

2. **A**

Source: https://me-mechanicalengineering.com/wp-content/uploads/2015/11/heat-transfer.jpg
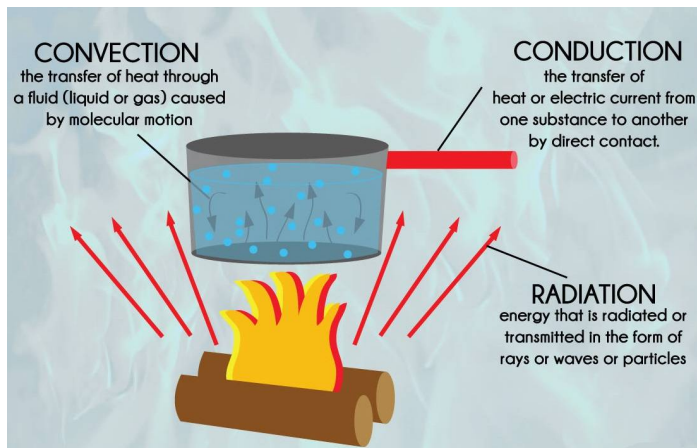
   Convection is the heat transfer through a fluid. The differences in temperature produce convection currents. The less dense or hotter parts of the fluid rise while cooler or denser areas sink. Birds and gliders make use of upward convection currents to rise.

3. **B**
   Air travels from an area of high pressure to an area of low pressure to 'even out' the pressure difference and to produce equilibrium.

4. **B**
   The feather quickly reaches a balance of forces and thus a zero acceleration or terminal velocity. However, the coconut never reaches a terminal velocity during its fall because the forces never become completely balanced. Therefore, there's still acceleration and it falls faster than the feather because it has a far greater weight. It continues to accelerate as it falls, approaching a terminal velocity yet never reaching it. However, the feather does not require much air resistance before it ceases its acceleration and it obtains the state of terminal velocity in an early stage of its fall. The small terminal velocity of the feather means that the remainder of its fall will occur with a small terminal velocity.

5. **B**
   The seven colors of the visible spectrum are formed by the refraction of a composite light, such as white light, when it passes through a transparent medium.

Source:http://apollo.lsc.vsc.edu/classes/met130/notes/chapter19/sundogs.html
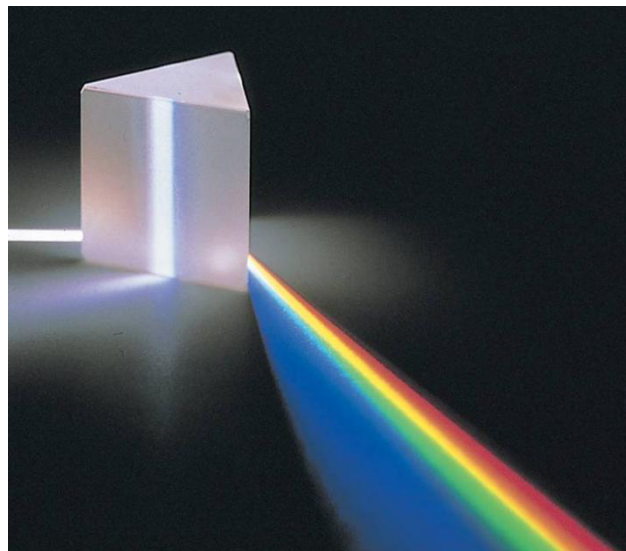
6. **B**
   Plant photosynthesis occurs in leaves and green stems. Since green objects reflect the color green and absorbs all the other components of white light (ROYBIV), then the plants can only use these components in photosynthesis. Thus, if a plant is placed under green light, then it will reflect all light and absorb none. Thus, photosynthesis will not occur in this setup.

7. **B**

Blood flows through the heart as follows:
   Superior/Inferior Vena Cava → Right Atrium → Tricuspid Valve → Right Ventricle → Pulmonary Valve → Pulmonary Artery → Lungs → Pulmonary Veins → Left Atrium →Bicuspid (Mitral) Valve → Left Ventricle → Aortic Semilunar Valve → Aorta → Entire body

Source: http://intensivecare.hsnet.nsw.gov.au/shock
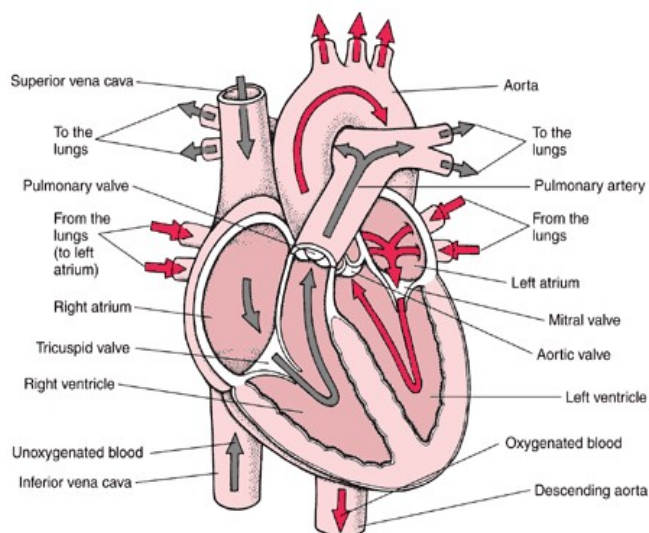
8. B

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
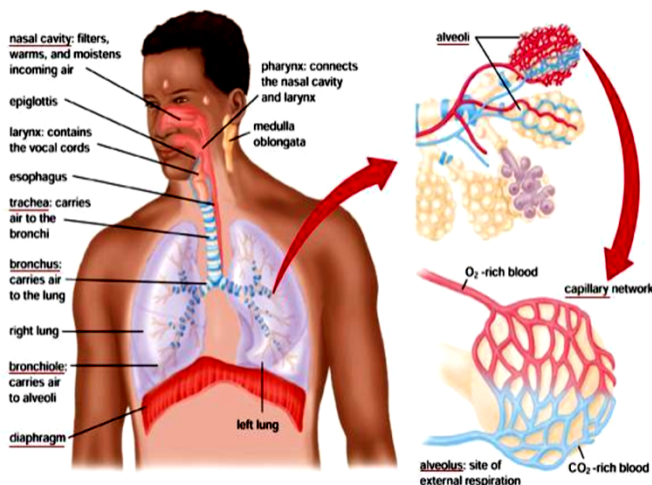
9. B

Angiosperms		
	Monocot	**Dicot**
Cotyledons	1	2
Venation	parallel	netted
Petals & Sepals	in 3's	in 4's or 5's
Root System	fibrous	taproot
Vascular System	scattered	in rings

10. A

Monera is a kingdom which consists of all prokaryotic organisms, which are simple, single-celled organisms.

11. C

A virus consists of genetic material (RNA/DNA) which is surrounded by a protective protein coating called capsid. It is not considered free-living since it cannot reproduce outside of a living cell. Viruses have evolved to pass on their genetic information to living cells so it can replicate along with the cell.
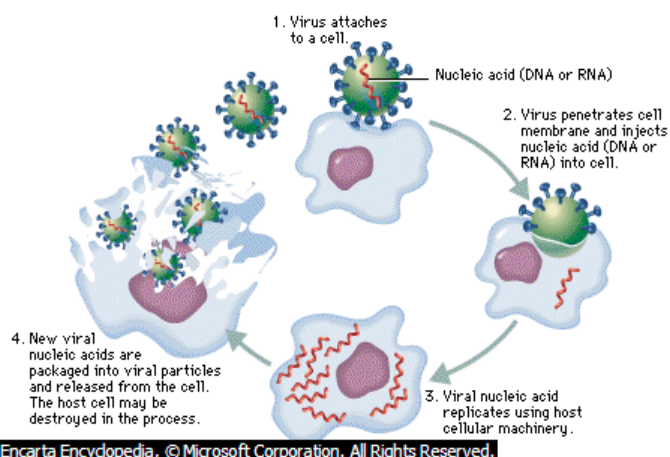
12. A

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 rat could be next to cabbage in the food chain, snails cannot eat any organism in the chain aside from cabbage.

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

13. 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.

14. **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.

15. **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 from migrating. In addition, the adaptation of an organism to its environment is a good trait and will probably be passed on to its offspring.

16. **D**

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

Source: Adv Neonatal Care © 2004 W.B. Saunders
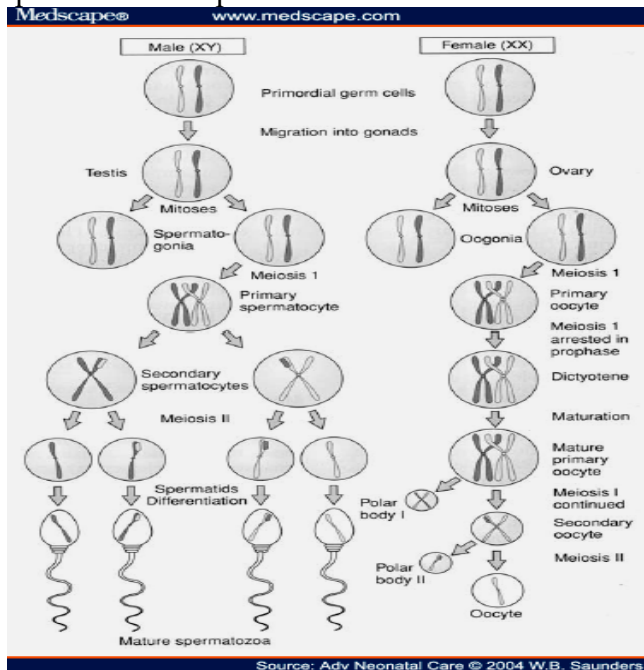
17. **B**

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.

18. **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.

19. **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*.

20. **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' ATGCT 5'**
After	5' UACGA 3'

21. **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.

22. B

	w/cell wall	w/ mitochondria	w/ nucleus	w/ ribosomes
Monera	OK	-	-	OK
Protista	-	OK	OK	OK
Fungi	OK	OK	OK	OK
Plantae	OK	OK	OK	OK
Animalia	-	OK	OK	OK

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

23. 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.

24. 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.

25. 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 on the Cenozoic era.

26. 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.

27. A

The Paleozoic era is the oldest and the Cenozoic era is the newest. Thus, the organisms that evolved the most recent are in the group with a starting point that is nearest the Cenozoic era, which are the Chordates.
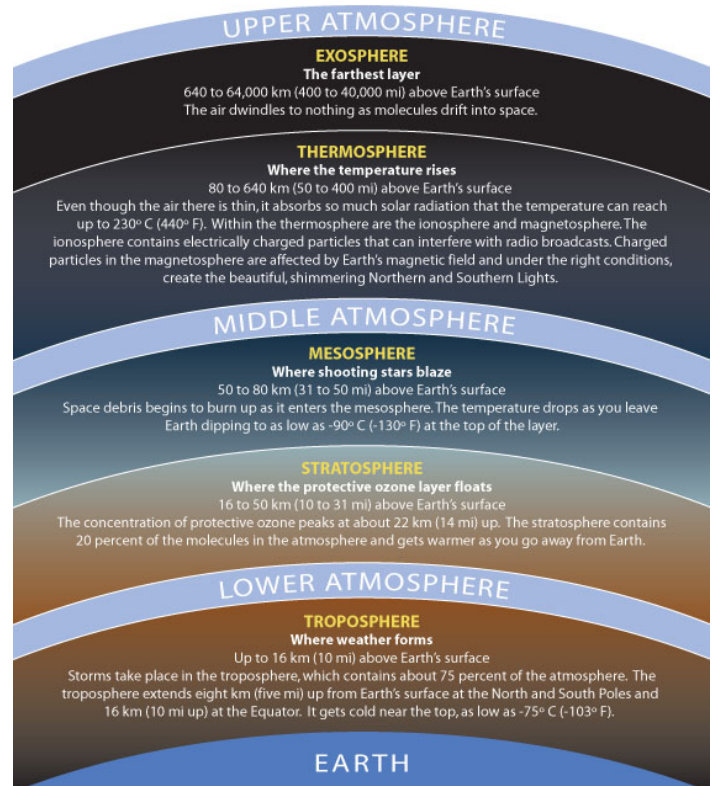
28. C

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.

29. B

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

30. C

Source: http://forces.si.edu/atmosphere/04_00_01.html

The coldest layer of the atmosphere is the mesosphere.

31. A

Weather is formed in the troposphere. It is also where most clouds and 99% of the water vapor are found. Since rain is water condensed from water vapor and falls as drops from clouds, then we can say that rain comes from the troposphere.

32. **D**

A transmitter radiates energy upwards toward the thermosphere where it will be refracted by ions, downwards to the surface of earth. Radio signals can be sent to farther places through this method than if propagated through the surface of the Earth, since there are many obstructions in the surface of Earth.

33. **C**
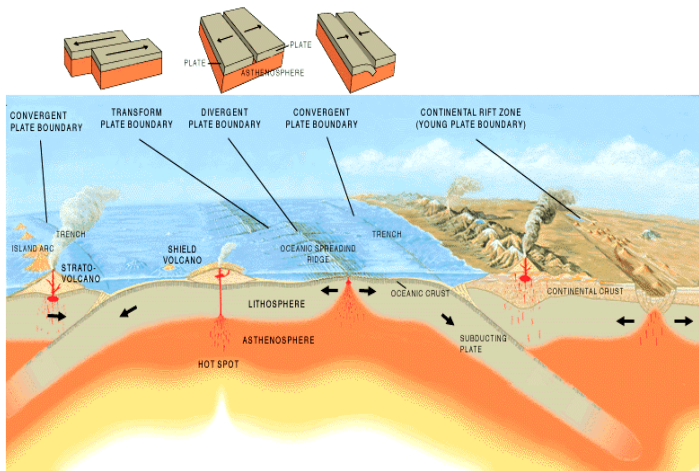
Source: http://www.eoearth.org/article/Mid-ocean_ridges?topic=50013

Mid-ocean ridges are formed when two tectonic plates diverge or move away from each other. When this forms, magma rises up and cools down, forming new rocks.

34. **C**

Source: http://www.space.com/62-earths-moon-phases-monthly-lunar-cycles-infographic.html
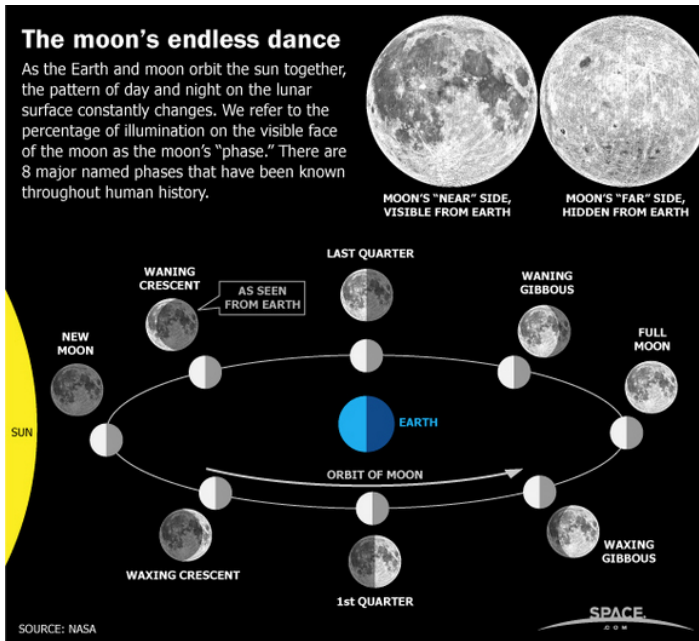
35. **D**

The Sun, which is our nearest star, is found approximately 150 million kilometers from the Earth. It is also about 250,000 times closer to Earth than Proxima Centauri – the next closest star. Proxima Centauri is found more than 30 trillion kilometers from Earth.

36. **C**

Source: https://lifeboat.com/blog.images/uranus-is-a-real-oddball-in-our-solar-system.jpg
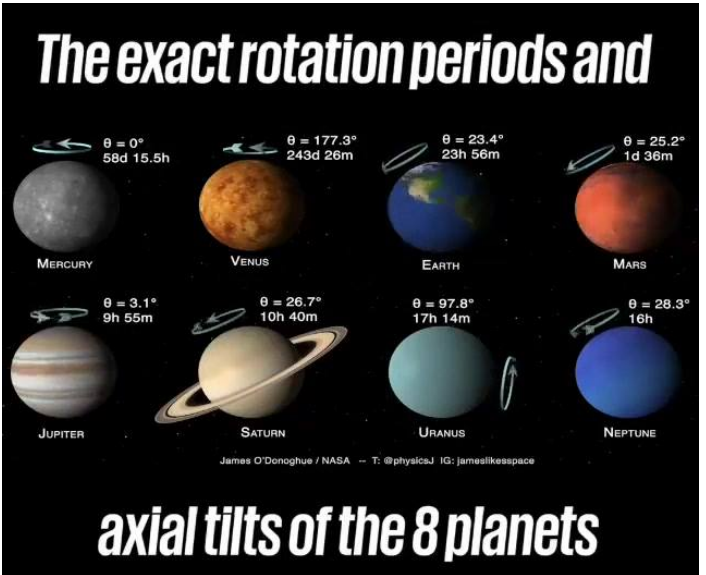
Most of the planets in the Solar System orbit the sun like a top spinning across the floor, with their spin-axes more or less vertical to their direction of motion however, Uranus rolls along its orbital plane like a wheel when it rotates.

37. **A**

Mercury is a metallic element that is liquid in room temperature. It is used in thermometers and barometers. Zirconium is a grayish-white metallic element used in coating fuel rods in nuclear reactors. Carbon dioxide is a compound consisting of two oxygen atoms and a carbon atom that are covalently bonded. Milk on the other hand is a mixture of water and milk solids such as carbohydrates, proteins, fat and minerals.

38. **C**

Change	Example
1. Change in color	metal rusting $4Fe + 3O_2 + 6H_2O \rightarrow 2Fe_2O_3 \cdot nH_2O$
2. Evolution of gas	fizz (carbon dioxide) formed by pouring vinegar to baking soda

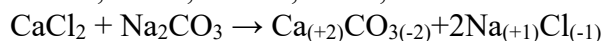|	CH₃COOH+NaHCO₃→ CH₃COONa+H₂O+CO₂(g)
3. Precipitate formation	Redox reaction between silver nitrate and sodium chloride $AgNO_3+NaCl\rightarrow AgCl_{(s)}+NaNO_3$

39. **B**

    Selenium is a nonmetallic element used in copper mining.

40. **B**

Charges:
Ca: +2, Cl: -1, Na: +1, C: +4, O: -2
$CaCl_2 + Na_2CO_3 \rightarrow Ca_{(+2)}CO_{3(-2)}+2Na_{(+1)}Cl_{(-1)}$

41. **C**

$$mass = \left(9.1\ x\ 10^{-28} \frac{grams}{atom}\right)(6.02\ x\ 10^{23}\ atoms)$$
$$= 5.4782\ x\ 10^{-4}\ grams \approx 5.78\ x\ 10^{-4} grams$$

42. **C**

    Gas constant (R), as its name implies, is a constant which defines the relation of the gas's pressure and volume to its absolute temperature (in Kelvin). Its value is $8.314\ \frac{joules}{Kelvin}$

43. **D**

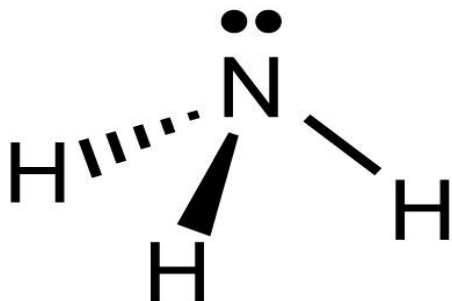   Organic compounds contain carbon, hydrogen and oxygen atoms. CH_3COOH or acetic acid is the main component in vinegar.

44. **D**

    A molecule is the smallest physical unit of a given substance which can exist independently. Thus, a glucose molecule is the smallest unit of glucose. It also still retains the physical properties possessed by glucose.
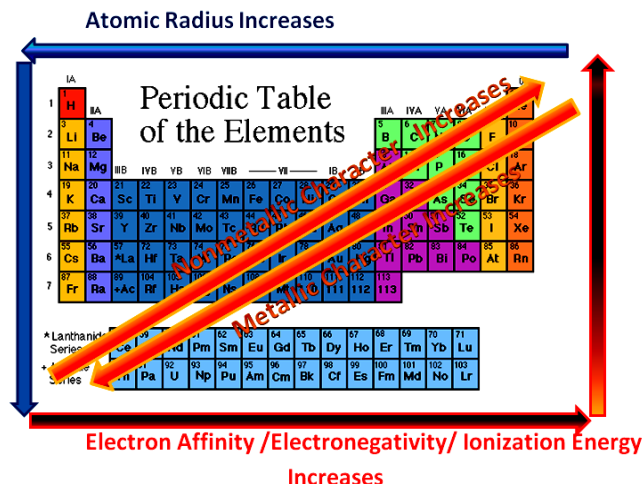
45. **B**

Source:http://chemistry.about.com/od/factsstructures/ig/Chemical-Structures---A/Ammonia-Chemical-Structure.htm

46. **D**

    Na (sodium) is an alkali metal. F (flourine) is a halogen. Xe (xenon) is a noble gas. No two of these elements are from the same family. Thus, none of these are similar.

47. **A**

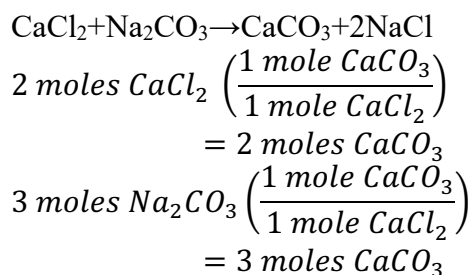Source:http://i150.photobucket.com/albums/s118/hi78953/chemwiki.png

    As we move across a period (row) from left to right, the number of electrons increases, thus increasing nuclear charge. This causes the attraction between the nucleus and electrons to increase. Thus, the electrons are being pulled more tightly by the nucleus. As a result, the radius or size of the atom decreases.
Atomic Radius: Li > B > O > F

48. **D**

    As we move across a period (row) from left to right, the valence shell of an atom is being filled up and attraction between the nucleus and electrons increases. Thus, more energy is released upon gaining an electron (higher electron affinity).
Electron Affinity: F > N > Be > Li

49. **B**

$CaCl_2+Na_2CO_3\rightarrow CaCO_3+2NaCl$
$$2\ moles\ CaCl_2 \left(\frac{1\ mole\ CaCO_3}{1\ mole\ CaCl_2}\right)$$
$$= 2\ moles\ CaCO_3$$
$$3\ moles\ Na_2CO_3 \left(\frac{1\ mole\ CaCO_3}{1\ mole\ CaCl_2}\right)$$
$$= 3\ moles\ CaCO_3$$

Since calcium chloride produces fewer moles of product than sodium carbonate, then calcium chloride is the limiting reactant.

50. **C**

Oxidation-reduction (Redox) reactions combine compounds wanting to gain electrons (reduce) and compounds willing to give electrons (oxidize).

51. **D**

If A is represented by $\oplus$, then 0.6 of the particles (in a container with a pressure of 0.6 atm) are $\oplus$. In choice d, 6 out of 10 or 0.6 of the particles are A.

52. **C**

Let x be the number of hours the girl travelled at 40 mph
5-x be the number of hours the girl travelled at 60mph

$$40mph\ (x\ hrs) + 60mph\ (5 - x\ hrs) = 240$$

$$40x + 300 - 60x = 240$$

$$-20x = -60$$

$$x = 3$$

53. **C**

Weight is the downward pull of Earth's gravity on any object.

54. **B**

If the strings of a guitar are plucked harder, then the vibrations that accompany the plucking will contain more (sound) energy.

55. **D**

A short circuit is a failure in an electric circuit is caused by excessive flow of current due to negligible (or no) resistance.

56. **D**

$$Voltage_{total} = 1\ volt + 3\ volts + 4\ volts$$
$$= 8\ volts$$

57. **C**

$$R_{total} = 1\Omega + 1\Omega + R_{parallel}$$
$$3 = 1\Omega + 1\Omega + R_{parallel}$$
$$R_{parallel} = 1\Omega$$
$$\frac{1}{R_{parallel}} = \frac{1}{2\Omega} + \frac{1}{R}$$

$$\frac{1}{1\Omega} = \frac{1}{2\Omega} + \frac{1}{R}$$
$$1 = \frac{1}{2} + \frac{1}{R}$$
$$\frac{1}{R} = \frac{1}{2}$$
$$R = 2$$

58. **A**

A wavelength is the distance between two points on neighboring waves that are in the same phase (For example: crest to crest or trough to trough).

59. **B**

$$Force_{left} = Force_{right}$$
$$Force = (mass)(distance)$$
$$(Mass)(4m + 2m) + (3kg)(2m) = (10kg)(3m)$$
$$Mass(6m) + 6N = 30N$$

$$Mass(6m) = 24N$$

$$Mass = 4kg$$

60. **D**

$$Work = (Force)(Distance_\perp)$$

Thus, there is no work done on an object if it doesn't move in a motion that is perpendicular from gravity.

If a cart is pushed a certain distance, then it moves at the surface of the Earth which is perpendicular from the pull of gravity.

Carrying a briefcase while going upstairs and climbing a mountain with a backpack involves moving in a diagonal motion, which consists of a vertical and a horizontal component. Thus, work is done in the first three examples.

The force exerted by a person's head to a basket placed on top of it is upwards. This force is parallel to the pull of gravity. Thus, there is no work exerted by the head to the basket.