

MOCK UPCAT 8 (SCIENCE UPDATE): ANSWER KEY WITH EXPLANATIONS

1. **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.

2. **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'

3. **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.

4. **D**

Multiple Alleles
Cross: AB x AO

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

	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%)

5. **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.

6. **D**

The three processes involve chemical reactions that change the materials into new substances with different properties.

7. **C**

Mass number equal to 23 is the sum of protons and neutrons. 11 is the atomic number equal to the number of protons. Since the Sodium cation has a charge of +1, it has less one electron compared to the number of protons. Therefore, it has 10 electrons.

8. **D**

Osmosis is a process where the solvent molecules transfer through a semi-permeable membrane from a diluted solution to a more concentrated one to achieve equilibrium in concentration. Therefore, pure water from B will move to A and C solutions.

9. **A**

Isotopes are variations of an element with different number of neutrons. The number of protons (and consequently the atomic number) is the same for isotopes of an element. A and B is the only pair with same number of protons, but different number of electrons as shown by the mass number.

10. **A**

Empirical formula shows the proportion of the elements but not the actual number of atoms in a compound. Lime water is an example of common name. Benzoyl peroxide is an example

of chemical name. Option B gives the actual number of atoms of the compound. Option A gives the simplest positive ratio of the elements involved.

11. C

The solubility of gases generally increases as the temperature decreases.

12. C

Permanganate ion is represented by the chemical formula MnO_4^- .

13. B


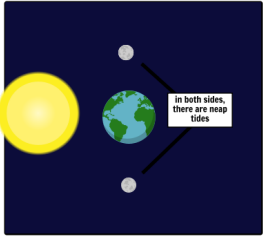
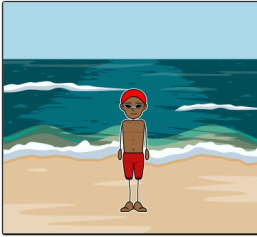
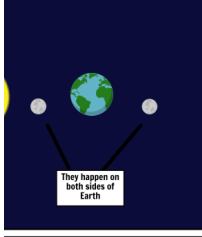
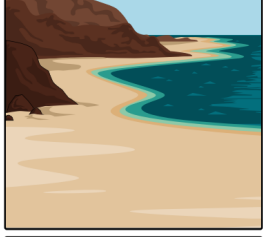
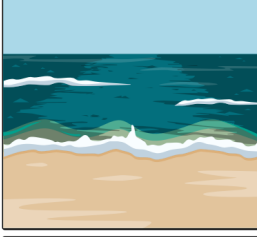
A plant material was found under ice in Antarctica. It can be inferred from this that Antarctica was once a tropical region.

“An unexpectedly warm period about 15 million years ago temporarily thawed Antarctica, turning the continent green around its edges, a new study says.” (Dell’Amore, 2012)

To read more about the article, kindly visit this link:

<https://news.nationalgeographic.com/news/2012/06/120620-green-antarctica-trees-global-warming-science-ancient/>

14. A

Neap Tides	The place of the moon	Spring Tides
		
happen during the first and last quarter. are low and very weak when they come to shore	The place of the moon is facing sideways towards the sun	Spring tides happen during the New or Full moon. They are very strong when they come to shore.
The Place of the Moon	Why Neap tides happen	Why Spring Tides happen
		
n of the moon is either in front of the sun or directly in front and behind Earth.	Neap tides happen because the waves go side to side although the moon is not there so they will not get pull more.	Spring tides happen because the Moon is facing the way the tides are moving, so the waves get pull more since they face the way of the Moon

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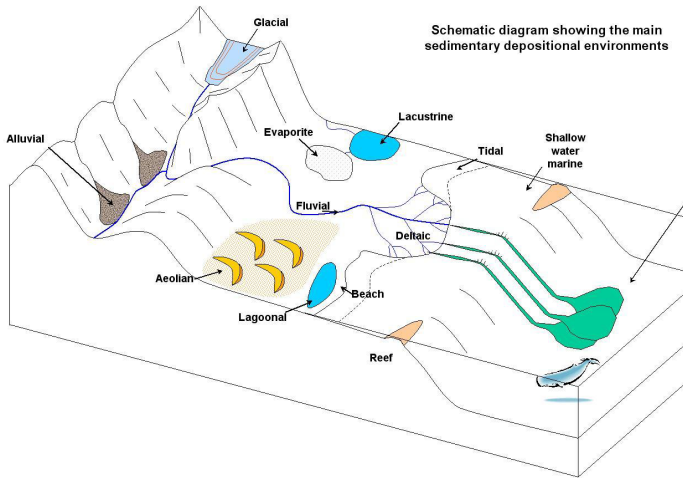
Source:

<http://sbt.blob.core.windows.net/storyboards/miguelvalenciadamian/spring-and-neap-tides.png>

Neap tides happen during the first and last quarter. Neap tides are low and weak when they come to the shore.

Low tide during neap tide is the best and safest time for Pong to conduct his experiment on marine studies.

15. D



Source: <http://opengeology.org/textbook/wp-content/uploads/2017/02/SedimentaryEnvironments.jpg>

Mountain > Valley > Gulf > Lagoon

Water is an integral part of all sedimentary rock formation. Weathering and erosion are common predecessors of sediments.

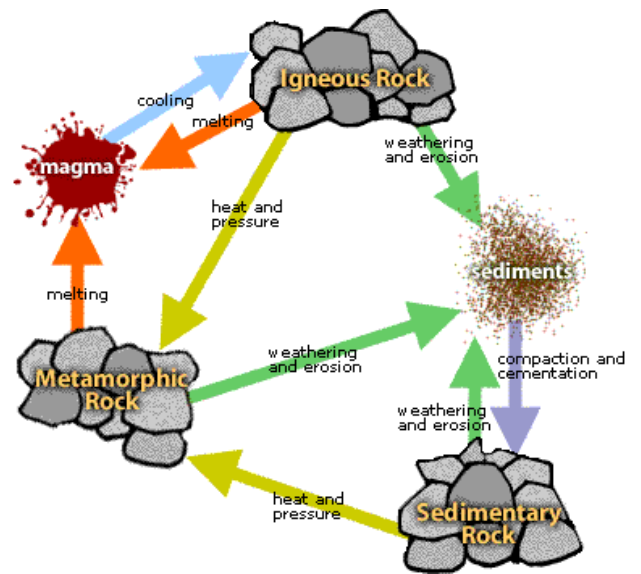
Sedimentary rocks can be formed in gulfs.

Sedimentary rocks can also form in lagoons because of solidified coal deposits.

Erosion causes sediments from mountains to erode into valleys.

In the mountain, sedimentary rocks are least likely to be found because it can be made up of mixture of the three types of rocks.

16. D

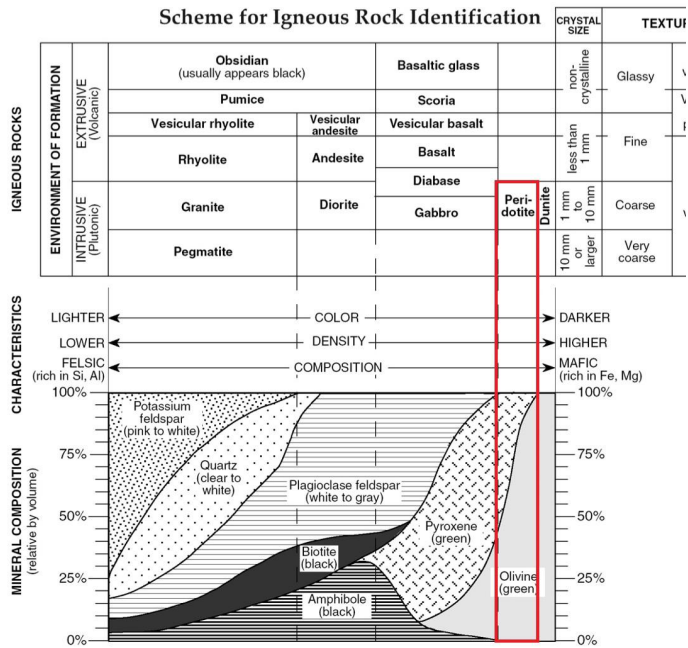


Source: <http://www.cotf.edu/ete/images/modules/msese/earthsysflr/EFCycleP2.gif>

Igneous rocks and sedimentary can be transformed directly to metamorphic rocks through heat and pressure. On the other hand, igneous, sedimentary and metamorphic rocks can be converted directly to sediments through weathering and erosion.

Sedimentary rocks cannot be directly transformed into igneous rocks because they have to change into metamorphic rocks first before they change into igneous. As shown in the figure above, there is no direct connection between sedimentary and igneous rocks.

17. D



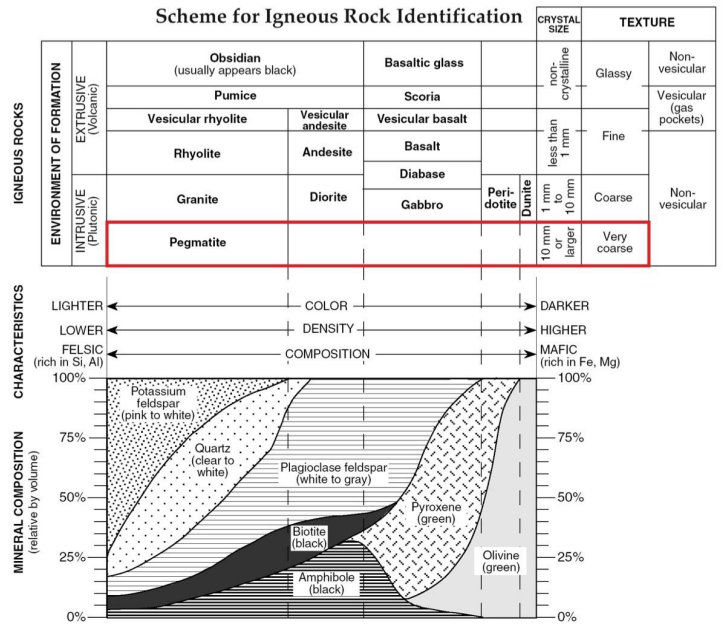
Source:
<https://cdn.thinglink.me/api/image/720668688289628162/1240/10/scaletowidth>

Based on the graph, peridotite is a coarse-grained igneous rock which composed of Pyroxene and Olivine.

18. D

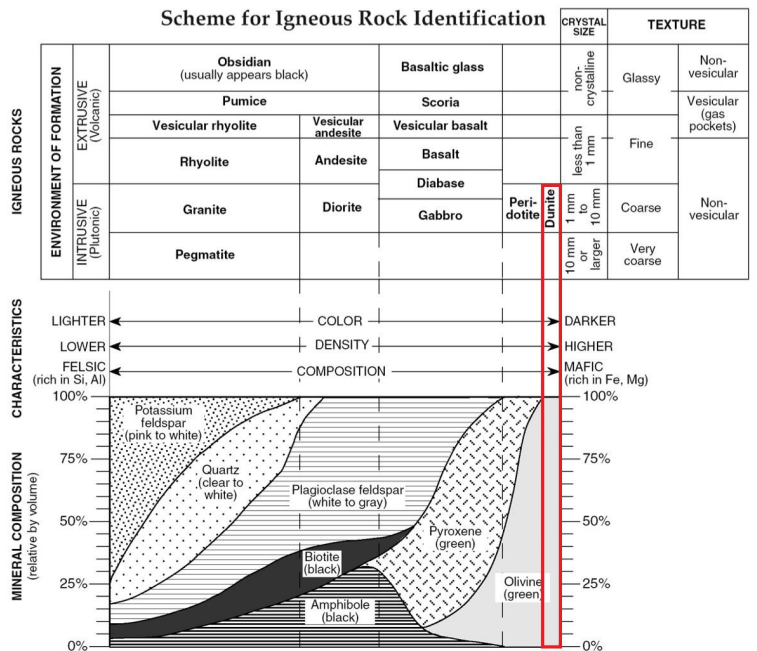
The extrusive igneous rocks (underwent solidification while on the earth's surface) are made up of the minerals plagioclase feldspar, biotite, amphibole, and a little quartz are andesite and vesicular andesite.

19. D



The lightest in color, least dense, and coarsest is pegmatite.

20. A



Dunite is made up of olivine.

21. **A**

Energy is power multiplied by time.
Considering the equal length of time, the appliance with the lowest power requirement will give the least amount of energy use.

22. **C**

A decrease in wavelength results to an increase in energy. Since violet has the shortest wavelength in the visible spectrum, violet must have the highest energy.

23. **A**

Basing on the Newton's Second Law of Motion, given the same amount of force, a body with less mass will have a higher acceleration.

24. **B**

The air resistance will slow down and decrease the acceleration of an object undergoing free fall. The velocity versus time graph will show velocity approaching a constant value implying a decreasing acceleration.

25. **C**

A lever must satisfy the equation $w_1d_1 = w_2d_2$.
To get w_2 ,

$$w_2 = w_1d_1/d_2 = (200\text{N})(3\text{m})/(1.5\text{m}) = 400 \text{ N}$$

26. **C**

Due to the Law of Inertia, the sleeping passenger will resist the acceleration and try to stay at rest. So, when the bus moves forward, the sleeping passenger will move backward to resist the change in motion.

27. **B**

The range of a projectile motion can be computed as:

If $\alpha = 0^\circ$, then the range will have the highest value.

Thus, the ball must be thrown straight horizontally.

28. **C**

Momentum = mv

Body	Mass (kg)	Velocity (m/s)	Momentum (kg m/s)
A	1	5	5
B	2	4	8
C	3	3	9
D	4	2	8

29. **B**

KE = $\frac{1}{2} mv^2$

Body	Mass (kg)	Velocity (m/s)	KE (J)
A	1	5	12.5
B	2	4	16
C	3	3	13.5
D	4	2	8

30. **D**

Wavelengths are measured from 1 peak to another peak (crest to crest or trough to trough).

31. **D**

Period is the amount of time it takes for one cycle to complete.

Frequency is a measurement of how many cycles can happen in a certain amount of time.

Wavelength is defined as the distance from a particular height on the wave to the next spot on the wave where it is at the same height and going in the same direction. Amplitude is a measure of how big the wave is.

32. **B**

$$W = F \times d = 1000 \text{ N} \times 4 \text{ m} = 4000 \text{ J}$$

33. **A**

$$P = W/s = 4000 \text{ J} / 5\text{s} = 800 \text{ Watts}$$

34. **B**

The voltage in a parallel circuit is just the same.

35. **D**

The same magnitude of force at the opposite direction must be applied to stop the box.

36. **B**

$$F = ma; a = v/t$$

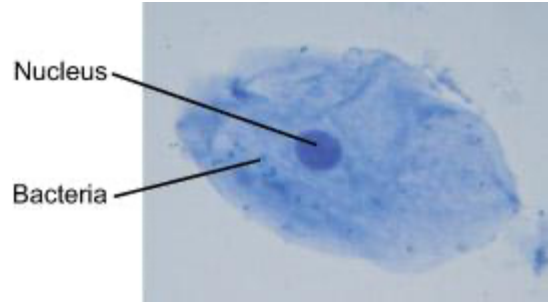
$$F = mv/t$$

$$t = mv/F$$

$$t = (5\text{kg}) \times (2\text{m/s}) / (10\text{N})$$

$$t = 1 \text{ second}$$

37. **C**



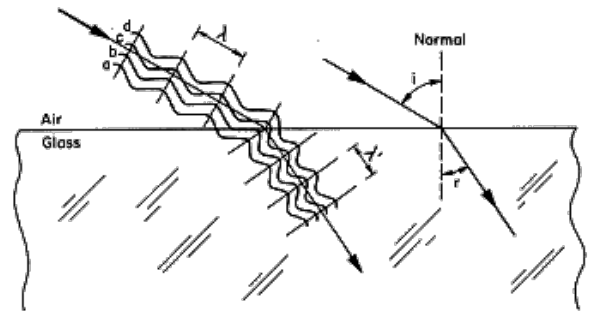
Source: <https://www2.mrc-lmb.cam.ac.uk/microscopes4schools/media/cheekcell.jpg>

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.

38. **D**

It is not polar since there is no net charge due to equal number of protons and electrons. It is not an anion because the atom has no excess negative charge. **It has 17 amu.**

39. **C**

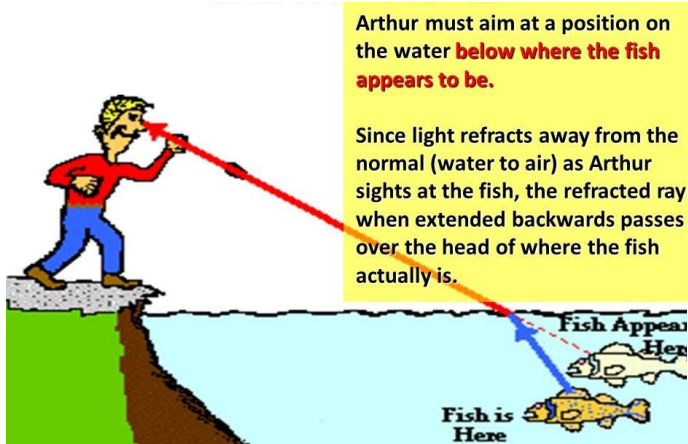


Source: <https://www.asu.edu/courses/phs208/patternsbb/PiN/rdg/refraction/figure3.gif>

Refraction is an effect that occurs when a light wave, incident at an angle away from the **normal**, passes a boundary from one medium into another in which there is a change in velocity of the light. Light is refracted when it crosses the interface from air into glass in which it moves more slowly. Since the light speed changes at the interface, the **wavelength** of the

light must change, too. The wavelength decreases as the light enters the medium and the light wave changes direction.

40. B



Source: https://images.slideplayer.com/29/9482833/slides/slide_8.jpg

41. A

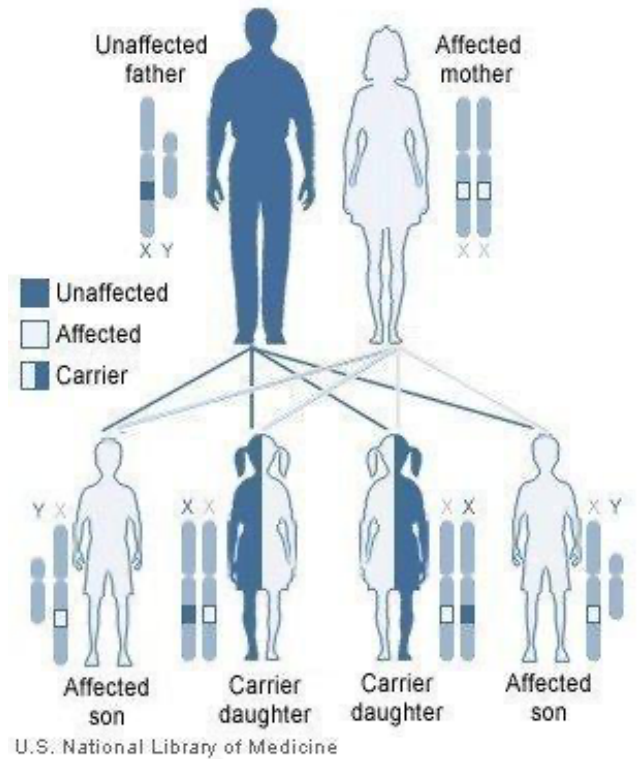
Glass has a Mohs Hardness of 5.5. Calcite has a Mohs hardness of 3. Quartz, Topaz, and Diamond have Mohs hardness greater than 5.5. Since calcite has Mohs hardness lower than glass, it cannot cut through or scratch glass.

42. C

The number of atoms is the number of moles multiplied by Avogadro's number. The higher the number of moles of a substance, the higher the number of atoms will be. 4 moles of NaOH will have more atoms than the 1 mole of water, 1 mole of carbon dioxide, and 1 mole of Ammonium carbonate.

43. A

X-linked recessive, affected mother



All males will have the disease.

Source:

<http://www.perinatology.com/images/XlinkRecessiveX2.jpg>

44. B

$$g = Gm/r^2$$

If mass is constant and G being the universal gravitational acceleration, if the radius is halved, the gravitational acceleration will four times the original. Since weight is equal to mass times acceleration, the weight of an object will also be four times the original. Therefore, IV is true.

$$F = Gm_1m_2/r^2$$

With radius halved and the masses constant, the gravitational force/ gravitational pull will also increase by four times. Therefore, III is true. Density is mass divided by volume. With volume being halved and mass constant, the density will be twice the original.

45. A

Mushroom is an example of fungi. The fungi were once considered to be plants because they grow out of the soil and have rigid cell walls.

Source: <https://www.cliffsnotes.com/study-guides/biology/plant-biology/fungi-not-plants/a-kingdom-separate-from-plants>

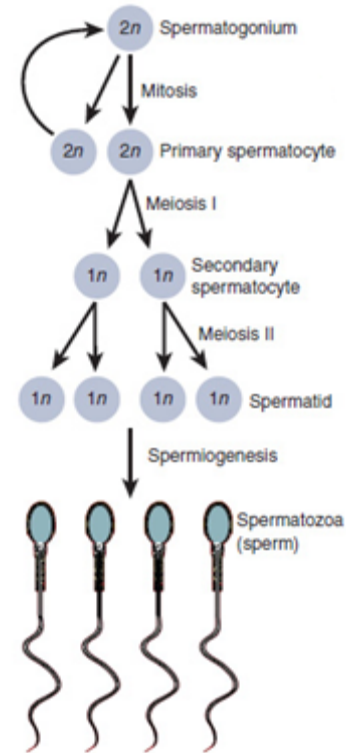
46. C

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>

47. 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

48. 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 stomata to close decreasing the rate of transpiration.

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

Source:
<https://water.usgs.gov/edu/watercycletranspiration.html>

49. D

The structure of Thermos bottle does not allow any of the three modes of heat transfer. The inner bottle contains silver coating that minimizes heat transfer by radiation. The vacuum between the walls minimizes heat transfer by convection. The glass wall is thin enough to minimize transfer of heat through convection.

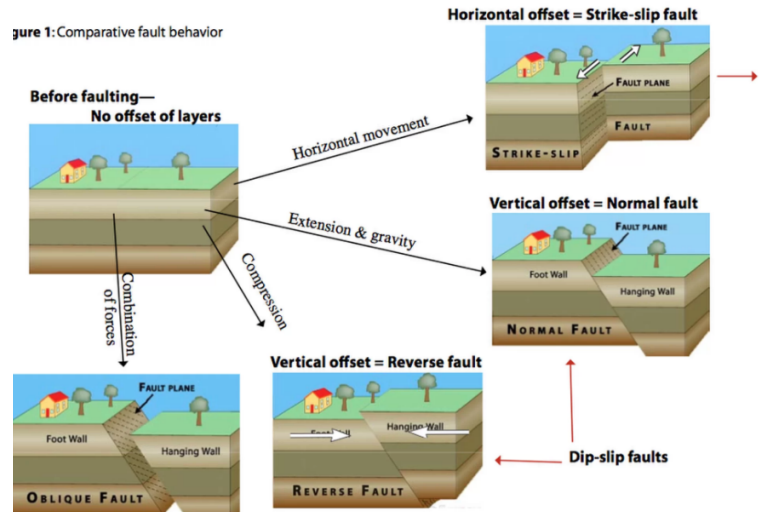
50. C

There are three types of faults: normal fault, reverse fault and strike-slip fault.

When two plates move in different directions, one plate slides downwards away from the other due to crustal stretching, it is called **normal fault**. This fault is defined when a hanging wall moves downward as a footwall moves upward.

Opposite the normal fault is the **reverse fault**, where two plates move towards each other, causing one plate to slide underneath another or slide upward due to colliding pressure. For this type, the hanging wall moves upward as the footwall moves downward.

One type of reverse fault is the **thrust fault** where plates move at angle of 30 degrees. **Strike-slip fault**, the third type of fault, occurs when two plates slide side by side instead of going up or down.



Source: <https://www.livescience.com/37052-types-of-faults.html>

51. B

Fossilization is the formation of fossils after an organism dies. Fragments of bone, shell, and such are slowly detached from the organism. Hard parts are buried and changed into new material, usually minerals. Moreover, due to a faster rate of burial of the organism, these body parts are usually destroyed without being altered, leaving an impression of a mold. Due to the continuous movement of plates, some fossils arise to the surface or become discoverable by scientists.

52. A

53. **D**

A niche is the functional role of an organism in an ecosystem. If an organism can survive in any type of environment without any problems with food and space it can occupy, we can say that this organism has a broad niche. An organism with a broad niche has many choices for food, meaning it can occupy several trophic levels. In the food web provided, eagle is shown to have the most choices for food, thus having the broadest niche.

54. **D**

Two setups were made for the experiment. Setup A was exposed to sunlight, whereas Setup B was put into darkness. In both setups, gas was shown to be produced. This means that in the presence or absence of light, certain types of gases can still be produced.

55. **C**

This experiment is called the glowing wood splint test. This is used to detect the presence of oxygen through burning, since combustion requires oxygen, fuel, and heat to produce a fire.

56. **D**

The chemical name of limewater is calcium hydroxide, $\text{Ca}(\text{OH})_2$. Since limewater is exposed to Gas B, it forms a cloudy white substance, chalk or calcium carbonate CaCO_3 , upon reaction with carbon dioxide.

57. **B**

In the given problem, it is stated that right-handedness is dominant. We can give a representation 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.

58. **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'

59. **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.

60. **A**

Condensation occurs when gases are cooled down, whereas evaporation occurs when liquids are exposed to higher temperatures. If the dew on the leaf will be heated, this will become water vapor due to evaporation.

61. **C**

When two objects are at thermal equilibrium, they are of the same temperature. Therefore, there is no driving force for heat to transfer.

73. **B**

74. **C**

75. **B**

62. **B**

76. **D**

Buffers prevent drastic changes in pH of a system. Buffers neutralize added acid or base inside the body because too much acidity or alkalinity may cause various complications to our body organ, especially to the kidney.

77. **B**

78. **C**

79. **C**

80. **A**

63. **B**

81. **D**

The Law of Acceleration states that the acceleration of an object increases when the force applied is high or the mass of the object is low, thus:

82. **A**

83. **D**

84. **C**

$$a = \frac{F}{m}$$

85. **D**

$$a = \frac{50\text{kg m/s}^2}{5 \text{ kg}}$$

86. **D**

$$a = 10 \text{ m/s}^2$$

64. **B**

65. **C**

66. **C**

67. **B**

68. **D**

69. **B**

70. **A**

71. **B**

72. **D**