

1- Answer: B) Jane Austen

2- Answer: C) The Greeks were the first to observe stars and planets

Explanation: The text mentions that early civilizations observed stars and planets for practical reasons, but it does not imply that Greeks were the first to observe them. The other options are either stated or can be inferred from the text.

3- Answer: A) The discoveries of Galileo were celebrated by the scientific community

Explanation: In this sentence, the action is being done to the subject (the discoveries of Galileo), which is typical of the passive voice. The other sentences are in active voice.

4- Answer: A) The Union and the Confederacy

Explanation: The American Civil War (1861–1865) was fought between the Union (Northern states) and the Confederacy (Southern states). None of the other options are relevant to this conflict.

5- Answer: B) 15,000

Explanation: First, calculate the total percentage for fiction and non-fiction books: $45\% + 30\% = 75\%$. This means that 25% of the books are reference materials. 25% of 60,000 is 15,000 books ($60,000 \times 0.25 = 15,000$).

6- Answer: C) 4:1

Explanation: Substance A will be halved three times in 6 hours, and B will be halved twice in 6 hours. Lets say A is 8k, and B 1k.

A: $8k \rightarrow 4k \rightarrow 2k \rightarrow 1k$

B: $1k \rightarrow 0,5k \rightarrow 0,25k$

Ratio will be 1k:0,25k which equals to 4:1

7- Answer: B) \$152

Explanation: First, apply the 20% discount: $\$200 (\$200 \times 0.20) = \$160$. Then, apply the additional 5% discount on \$160: $\$160 (\$160 \times 0.05) = \$152$.

8- Answer: B) The study does not take into account whether students who listened to music were naturally better at math.

Explanation: If the survey would assess some students who used to not listen to music while studying and their math skills after listening to music while studying, this argument would not have this flaw.

9- Answer: A) Emma did not bring an umbrella, so it did not rain.

Explanation: The statement says that if it rains, Emma will bring an umbrella. Therefore, if she did not bring an umbrella, we can deduce that it did not rain. The other statements cannot be logically concluded based on the information given.

The option D might be confusing, but we do not know exactly if she brings an umbrella some days even if it does not rain.

10- Answer: A) Oxidative phosphorylation

Explanation: Oxidative phosphorylation is the main process occurring in the mitochondria that produces ATP through the electron transport chain and chemiosmosis.

11- Answer: B) They stabilize the helical and sheet structures in the secondary structure

Explanation: In proteins, hydrogen bonds stabilize the alpha-helix and beta-sheet structures in the secondary structure, providing stability to the protein's shape.

12- Answer: A) In the stroma of the chloroplast

Explanation: The light-independent reactions (Calvin cycle) take place in the stroma, where CO_2 is fixed to produce glucose.

13- Answer: A) Cellulose

Explanation: Cellulose is a polysaccharide that provides structural support in plant cell walls. In different organisms, there are different molecules making the cell wall.

14- Answer: A) It forms part of the RNA backbone

Explanation: Ribose is the five-carbon sugar in RNA nucleotides, forming the backbone along with phosphate groups.

15- Answer: A) A protein channel that facilitates the movement of water across cell membranes

Explanation: Aquaporins are specialized channels in cell membranes that allow water molecules to pass through rapidly.

16- Answer: A) Loop of Henle

Explanation: The Loop of Henle, particularly its descending limb, reabsorbs water, concentrating the urine.

17- Answer: A) Condensation

Explanation: A condensation (or dehydration) reaction links two amino acids by forming a peptide bond, releasing water in the process.

18- Answer: A) Nucleus

Explanation: The nucleus is a membrane-bound organelle found in eukaryotes where DNA is stored and packaged.

19- Answer: A) Centrosome

Explanation: The centrosome organizes microtubules and forms spindle fibers that separate chromosomes during cell division.

20- Answer: A) A series of flattened, membrane-bound sacs

Explanation: The Golgi apparatus consists of stacked, flattened sacs that process, package, and transport proteins and lipids.

21- Answer: A) Sympathetic nervous system

Explanation: The sympathetic nervous system activates the body's "fight or flight" response, preparing it for action.

22- Answer: A) Cholesterol

Explanation: Cholesterol is present in animal cell membranes, where it helps maintain membrane fluidity and stability.

23- Answer: A) Endoplasmic reticulum-associated degradation (ERAD)

Explanation: ERAD is a cellular process that identifies and degrades misfolded proteins in the endoplasmic reticulum to maintain quality control.

24- Answer: A) Protein synthesis and folding

Explanation: The rough endoplasmic reticulum, studded with ribosomes, is involved in synthesizing and folding proteins.

25- Answer: A) Active transport

Explanation: Active transport moves molecules against their concentration gradient and requires ATP energy, unlike passive transport methods.

Answer: A) Allele

26- Explanation: Alleles are alternative forms of a gene located at the same position on homologous chromosomes.

27- Answer: A) Dominant

Explanation: A dominant allele can mask the effect of a recessive allele at the same locus, determining the phenotype.

28- Answer: A) The exchange of genetic material between homologous chromosomes during meiosis

Explanation: Genetic recombination occurs during meiosis and involves the exchange of DNA between homologous chromosomes.

29- Answer: A) Actin filaments

Explanation: Actin filaments, also known as microfilaments, are involved in muscle contraction, cell movement, and providing structural support. Microtubules are also used for cell movement, however they do not do contraction.

30- Answer: A) AUGCCU

Explanation: In RNA, adenine (A) pairs with uracil (U), and cytosine (C) pairs with guanine (G). Therefore, the mRNA sequence complementary to TACGGA would be AUGCCU.

31- Answer: A) RNA polymerase

Explanation: RNA polymerase is the enzyme that synthesizes RNA from a DNA template during transcription, reading the DNA strand to create a complementary RNA strand.

32- Answer: B) It signals where RNA polymerase should begin transcription

Explanation: The promoter region is a specific DNA sequence that signals RNA polymerase to bind and start transcription. It plays a crucial role in regulating gene expression.

33-Answer: B) SO_2

Explanation: When dissolved in water, SO_2 forms sulfurous acid (H_2SO_3), which is an acidic solution. Non-metal oxides like SO_2 tend to form acids in water. In contrast, metal oxides like CaO and MgO form basic solutions, while ZnO is amphoteric (can act as both acidic and basic under different conditions).

34- Answer: C) Atomic radius does not change, and electronegativity increases

Explanation: Moving from left to right across a period, the number of protons in the nucleus increases, pulling electrons closer to the nucleus, which decreases the atomic radius. Electronegativity increases because atoms have a stronger tendency to attract electrons due to the increased effective nuclear charge.

35- Answer: B) Brønsted base

Explanation: Ammonia (NH_3) acts as a Brønsted base because it accepts a proton (H^+) from HCl during the reaction to form NH_4^+ . The Brønsted–Lowry definition focuses on proton transfer, where a base is a proton acceptor. While NH_3 could also be classified as a Lewis base (it donates a lone pair of electrons), the key feature in this reaction is its role in accepting a proton, making "Brønsted base" the most appropriate answer.

36- Answer: B) 0.6 mol

Explanation: Each mole of MgCl_2 provides 2 moles of Cl^- ions. Therefore,
 $1,5 \text{ M} \times 0,2 \text{ L} = 0,6 \text{ mol of } \text{Cl}^- \text{ ions.}$

37- Answer: B) 3.01×10^{22}

Explanation: In a 1.6 g of O_2 sample, there are 0.05 moles of oxygen gas.

$$0.05 \times 6.022 \times 10^{23} = 3.01 \times 10^{22}$$

38- Answer: B) 0.8 atm

Explanation: Partial pressure is proportional to mole fraction.

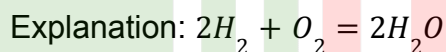
$$\text{Mole fraction of } N_2 = \frac{0.6}{0.6+0.4+0.8} = \frac{1}{3}$$

$$2.4 \times 1/3 = 0.8 \text{ atm}$$

39- Answer: A) 198 mL

Explanation: A change in pH from 1 to 3 means a 100-fold dilution. Therefore, to achieve this dilution, the initial 2 mL solution needs to be diluted to 200 mL total, so 198 mL of water should be added.

40- Answer: B) 54 g



8 g of hydrogen = 4 moles of H_2 , 64 g of oxygen = 2 moles of O_2

In a 100% yield reaction we would have 4 moles of water produced, but since it is 75% we will have 3 moles of water produced. The mass of 3 moles of water is 54 grams.

41- Answer: A) 10 atm

Explanation: Using the combined gas law $P_1/T_1 = P_2/T_2$

$$T_1 = 270 \text{ K}, T_2 = 300 \text{ K}$$

$$9/270 = x/300$$

$$x=10$$

42- Answer: A) HNO_3

Explanation: In this reaction:

Copper (Cu) is oxidized (from 0 to +2).

Nitrogen in HNO_3 is reduced (from +5 in NO_3^- to +2 in NO).

HNO_3 is the oxidizing agent because it accepts electrons from copper, allowing copper to be oxidized.

Thus, the correct answer is A) HNO_3 .

43- Answer: D) Ethyne

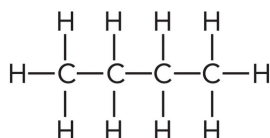
Explanation: Ethyne (C_2H_2) has the fewest hydrogen atoms (2), as it contains a triple bond. Other hydrocarbons, like propane (C_3H_8) and butane (C_4H_{10}), have more hydrogen atoms.

44- Answer: A) 40 mL

Explanation: Using the dilution equation $M_1 V_1 = M_2 V_2$, we obtain the following equation $(0.1\text{L})(0.5\text{M}) = (x\text{L})(0.1\text{M})$. Solving for x, we get 0.5L, or 50 mL. Because we started with 10mL, we need to add an additional 50mL - 10mL = 40mL.

45- Answer: C) Butane

Explanation: Butane (C_4H_{10}) is a saturated hydrocarbon with only single bonds between carbon atoms.



46- Answer: D) 2 mol of Al are needed to react with 3 mol of Cl_2

Explanation: The balanced equation shows that 2 mol of Al reacts with 3 mol of Cl_2 to form 2 mol of AlCl_3 .

47- Answer: B) The conjugate acid is the species formed when a base gains a proton

Explanation: According to Brønsted–Lowry theory, a conjugate acid is formed when a base accepts a proton (H^+).

48- Answer: A) 1500 J

Explanation: Work done is calculated as force times the displacement, $W = F \times d$. Therefore, the work done is $150\text{ N} \times 10\text{ m} = 1500\text{ J}$.

49- Answer: B) $1/\log_3(6)$

Explanation: $f(1) = \log_3(1^2 + 5) = \log_3(6)$, which cannot be further simplified. The reciprocal is $1/\log_3(6)$.

50- Answer: C) $\frac{5}{33}$ ※option B is also correct

Explanation: The probability of drawing a blue ball first is $5/12$. After drawing one blue ball, there are 11 balls left, with 4 red balls, so the probability of drawing a red ball next is $4/11$. The combined probability is $5/12 \times 4/11 = 5/33$.

51- Answer: C) Decreases by $2/3$

Explanation: Doubling the values of X and Y results in a $2^2 = 4$ -fold increase. With the reduction of the A to half, together, we increase the numerator by $(4)(\frac{1}{2}) = 2$ times. Since the denominator decreases by 3 times, in total, Q decreases by $\frac{2}{3}$.

52- Answer: D) 73

Explanation: For $f(g(3))$, we evaluate function $g(x)$ first, which gives us 5. Then we insert this value into the function $f(x)$, giving us $3(5)^2 - 2 = 73$.

53- Answer: A) $48\pi\text{ cm}^3$

Explanation: the formula for the volume of a cone is

$$V = \pi r^2 \frac{h}{3} = \pi 4^2 \frac{9}{3} = 48\pi\text{ cm}^3 .$$

54- Answer: C) 5×10^5

Explanation: For the numerator, we get $(4 \times 10^5)(4 \times 10^5) = 16 \times 10^{10}$. For the denominator, to subtract y from x, we convert x to have the same power of 10 as y, so $x - y = (40 \times 10^4) - (8 \times 10^4) = 32 \times 10^4$. Dividing the numerator by the denominator, we get $\frac{16 \times 10^{10}}{32 \times 10^4} = 0.5 \times 10^6 = 5 \times 10^5$.

55- Answer: A) The electron continues to move in a straight line.

Explanation: The magnetic force causes the electron to move in a circular path, not a straight line.

56- Answer: C) 4.5 kJ

Explanation: The amount of heat gained or lost by a sample can be calculated by the equation $Q = mc\Delta T$ for Q heat, m mass c specific heat capacity and ΔT for a change in temperature. Inserting values, we get

$$Q = (0.1 \text{ kg})(0.9 \text{ kJ/kg} \cdot \text{C})(70 - 20 \text{ C}) = 4.5 \text{ kJ}.$$

57- Answer: A) 50 A

Explanation: We can use Ohm's relationship $Power = Resistance \times Current^2$ for this problem. Inserting 25000 watts for power and 10 ohms for resistance, we require 50 amps of current for dissipation.

58- Answer: C) 0.6 kg/cm^3

Explanation: We start with the formula for weight, $Weight = mass \times gravity$, inserting 250 N for weight and $10/6 \text{ ms}^{-2}$ for the moon's gravity. Obtaining a mass of 150 kg and knowing the volume of the stone, we can calculate the density with the equation, $density = \frac{mass}{Volume}$. Therefore

$$density = 150 \text{ kg} \div 250 \text{ cm}^3 = 0.6 \text{ kg/cm}^3.$$

59- Answer: A) 3

Explanation: Using $a = 3$, $b = -9$, $c = 5$ for the quadratic formula

$(-b \pm \sqrt{b^2 - 4ac}) / 2a$, we get the following roots: $\frac{9 \pm \sqrt{21}}{6}$. Summing the two roots,

$$\text{Summing the two roots } \frac{9 + \sqrt{21} + 9 - \sqrt{21}}{6} = \frac{18}{6} = 3.$$

60- Answer: B) $5\sqrt{3} \text{ cm}$

Explanation: In a right triangle, if one of the angles is 30° , the other has to be 60° , meaning that this is a special 30-60-90 triangle. The lengths of the special right triangle follows the ratio, $1 : 2 : \sqrt{3}$.

We then create a line from the right angle to the hypotenuse inside the triangle to create two right triangles inside of the big one. Since we know that the hypotenuse of the smallest triangle is x , and the ratio of the hypotenuse to the side opposing 60° is $2 : \sqrt{3}$, the length of the altitude must be $\sqrt{3}x/2$.

Knowing $2x = 20 \text{ cm}$, therefore the altitude is $5\sqrt{3} \text{ cm}$ long.

