UNICUS OLYMPIADS

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Sample Paper

Class 8

Unicus Global Science Olympiad (UGSO)

Time: 60 minutes

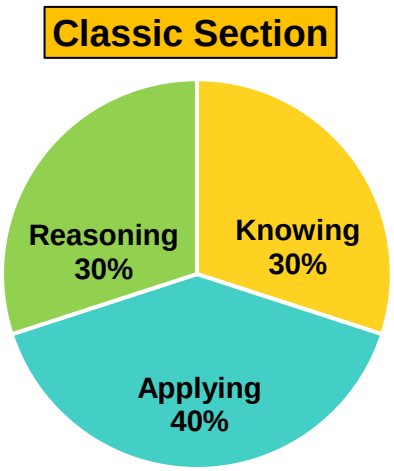
Pattern and Marking Scheme			
Section	**Total Questions**	**Marks per Question**	**Total Marks**
Classic Section	30	1	30
Scholar Section	15	2	30
Grand Total	**45**		60

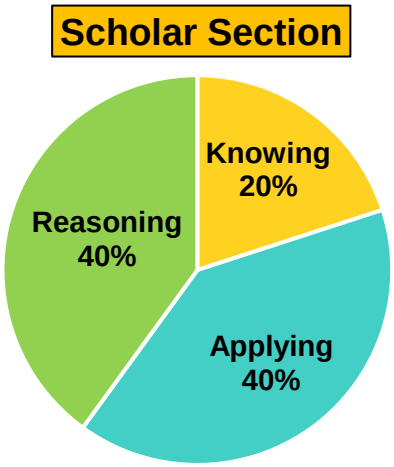
Unicus Global Science Olympiad (UGSO)

The **Unicus Global Olympiad** is organised around two dimensions:

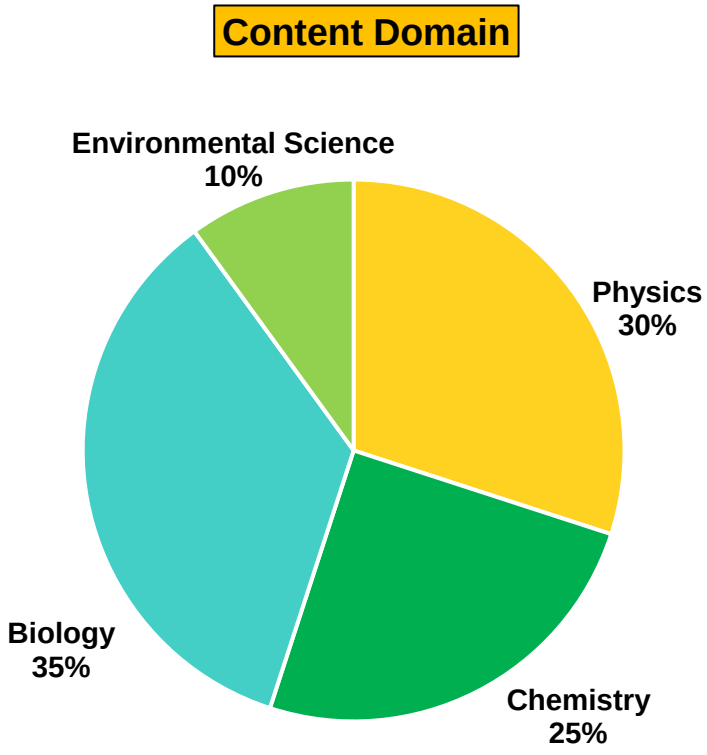
1. Content dimension, specifying the subject matter domains to be assessed
2. Cognitive dimension, specifying the thinking processes to be assessed

Target percentages of the question paper devoted to cognitive domains





Target percentages of the question paper devoted to content domains



For more details, visit https://www.unicusolympiads.com/.

Classic Section (Each Question is 1 Mark)

Cognitive Domain: Applying	Content Domain: Physics

1. Why does a glass of water left outside on a hot summer day evaporate faster than a glass of water left indoors?

a. The hot temperature outside increases the kinetic energy of water particles, leading to faster evaporation.
b. The indoor environment traps moisture, increasing the rate of evaporation process.
c. The hot temperature outside decreases the density of water particles, allowing them to escape into the air more easily.
d. The indoor environment compresses the water particles, preventing them from evaporating.

Cognitive Domain: Knowing	Content Domain: Physics

2. Consider a scenario where you have a metal rod, a glass of water, and a balloon filled with air. Which of these objects is most likely to demonstrate thermal expansion when heated?

a. The metal rod, because its particles are arranged closely together.
b. The glass of water, because its particles are able to move freely but are still closely packed.
c. The balloon filled with air, because gases expand more readily when heated.
d. All of the above objects will demonstrate thermal expansion equally.

Cognitive Domain: Knowing	Content Domain: Physics

3. A table is laid out with various objects of different shapes and sizes. Which object, when placed on the table, would exert the greatest pressure on the surface?

a. A hollow metal sphere with a large surface area
b. A light wooden block with a large base area
c. A medium-sized plastic block with a medium base area
d. A heavy iron block with a small base area

Cognitive Domain: Reasoning	Content Domain: Physics

4. A pulling force of 3.0 N causes a toy car to accelerate on a horizontal surface. The frictional force between the surface and the toy car is 1.0 N. Which of the following statements best describes the subsequent motion of the car when the pulling force is decreased to 1.0 N?

a. It will continue to accelerate.
b. It will decelerate.
c. It will move at a constant speed.
d. It will stop moving.

Cognitive Domain: Applying	Content Domain: Physics

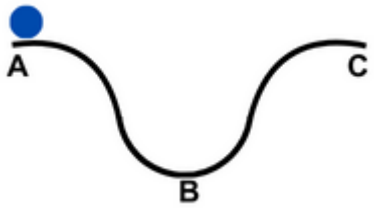
5. A body falls freely under the action of gravity. Which statement concerning its energy is/are correct? Assuming that the air resistance is negligible, _____.

A. it gains kinetic energy while falling
B. its total energy at any point of the flight is equal to the initial energy at the top of its flight
C. its gravitational potential energy at the end of the flight before it hit the ground is all converted to kinetic energy

a. A only
b. A and C only
c. B and C only
d. A, B and C

Cognitive Domain: Applying	Content Domain: Physics

6. An object moves along a frictionless track from A to C, through B, which is the lowest point of the motion.
Which graph shows how the kinetic energy of the object varies with the vertical distance from A?



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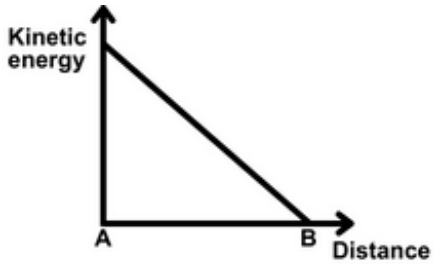

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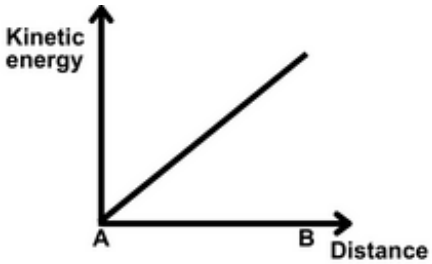

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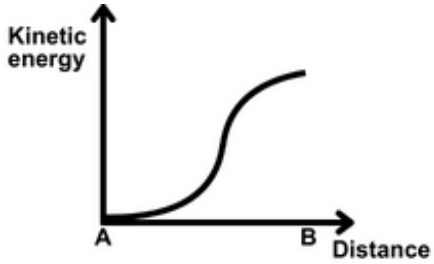

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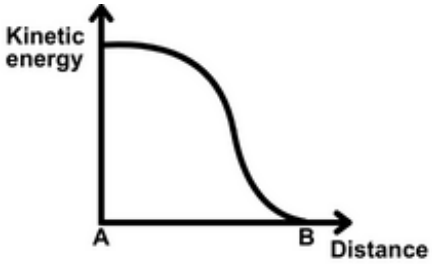


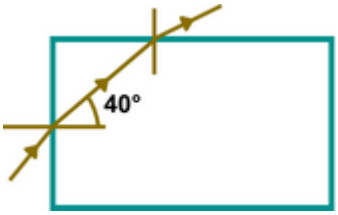
Cognitive Domain: Applying	Content Domain: Physics

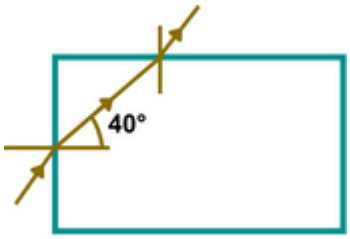
7. A group of students are testing how different surface roughness affects the braking distance of a skateboard. They test on smooth concrete, rough asphalt, and a synthetic track. If the skateboard's wheels are the same in all tests, which surface should they predict will have the shortest braking distance and why?

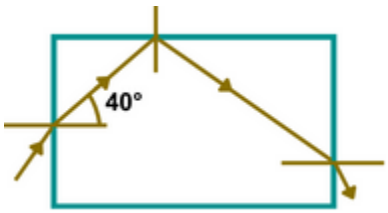
a. Smooth concrete, due to low rolling resistance
b. Rough asphalt, due to high static friction
c. Synthetic track, due to optimal rolling and static friction balance
d. Rough asphalt, because it increases sliding friction

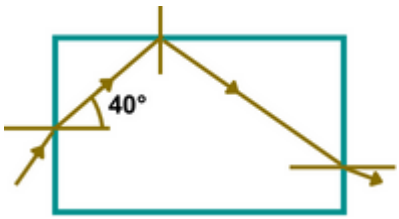
Cognitive Domain: Applying	Content Domain: Physics

8. A ray of light is incident on one side of a rectangular glass block. The angle of refraction is 40° in the glass. The critical angle for light in glass is 42°.
Which diagram shows the path of this ray?

a. 

b. 

c. 

d. 

Cognitive Domain: Reasoning	Content Domain: Physics

9. A long, straight wire carries a current. A small compass needle is placed at various points around the wire. It is observed that the needle deflects the most when placed directly above the wire. As the needle is moved horizontally away from the wire, the deflection progressively decreases. This observation can be best explained by which of the following statements?

a. The magnetic field strength is constant around the wire.
b. The magnetic field lines form concentric circles around the wire, with the strongest field closest to the wire.
c. The magnetic field strength alternates between positive and negative values depending on the position.
d. The compass needle is affected by the Earth's magnetic field and not the current in the wire.

Cognitive Domain: Applying	Content Domain: Chemistry

10. A beaker filled with water is placed on a heating coil. As the water heats up, the following observations are made:

-The temperature of the water increases.
-The volume of the water increases slightly.
-The density of the water decreases.

Based on these observations, which of the following statements is correct?

a. Temperature is an intensive property, and volume is an extensive property.
b. Temperature is an extensive property, and volume is an intensive property.
c. Temperature and density are intensive properties, and volume depends on both intensity and extensivity.
d. All three properties - temperature, density, and volume - are extensive.

Cognitive Domain: Knowing	**Content Domain: Chemistry**

11. During a chemical reaction, various changes occur at the atomic level. Select the all the statements that are true about a chemical reaction.

A. New elements are formed from the rearrangement of existing atoms.
B. All chemical reactions release energy.
C. The total number of atoms is conserved.

a. A only
b. A and B only
c. C only
d. B and C only

Cognitive Domain: Applying	**Content Domain: Chemistry**

12. You're a scientist studying a new material, Element X. You've been tasked with comparing it to three other well-known substances: diamond, sodium and copper.
Unfortunately, your equipment malfunctioned, and you only have the melting point data for Element X. Based on the limited data and the properties of the reference substances, which statement about Element X is most likely true?

Substance	Copper	Sodium	Diamond	Element X
Melting Point (°C)	1080	98	3500	560

a. It forms metallic bonds stronger than copper but weaker than sodium.
b. It forms ionic bonds stronger than diamond but weaker than copper.
c. It forms covalent bonds stronger than copper but weaker than sodium.
d. It forms covalent bonds stronger than sodium but weaker than diamond.

Cognitive Domain: Knowing	**Content Domain: Chemistry**

13. Metals react with acids to varying degrees. Some metals react readily, while others are less reactive. Identify the metal that is LEAST LIKELY to react with dilute acid at room temperature.

a. Copper
b. Sodium
c. Zinc
d. Magnesium

Cognitive Domain: Applying	Content Domain: Chemistry

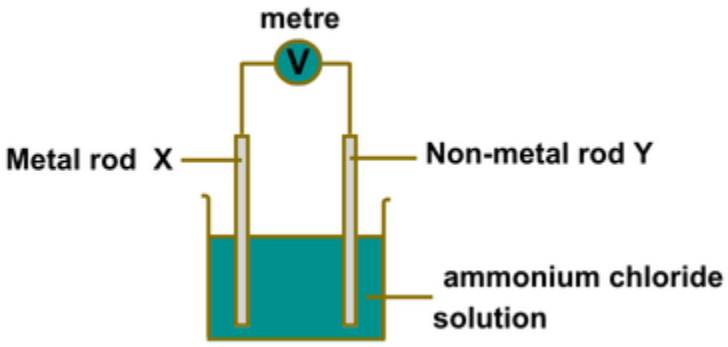
14. Metals can be extracted from their ores using different methods. Some metals, like iron, can be obtained by heating the ore alone. Others require additional processes like electrolysis due to their high reactivity.
Based on this concept, identify the metals that can be obtained from their ores simply by heating.

A. Potassium
B. Aluminium
C. Lead
D. Tin

a. A and B only
b. B only
c. C and D only
d. B, C and D only

Cognitive Domain: Reasoning	Content Domain: Chemistry

15. You have a setup (as shown in the image below) in a beaker containing an aqueous solution of ammonium chloride (NH_4Cl). Ammonium chloride is a well-known electrolyte, meaning it readily dissolves in water and allows the flow of electricity through the solution.
You want to create a circuit where electrons flow from rod X to rod Y.
Considering the setup, select the elements that would be the accurate choice for X and Y.



a. Rod X - Iron, Rod Y - Copper
b. Rod X - Graphite, Rod Y - Zinc
c. Rod X - Zinc, Rod Y - Nickel
d. Rod X - Aluminium, Rod Y - Graphite

Cognitive Domain: Knowing	Content Domain: Chemistry

16. The calorific value of a material helps predict its behaviour in a fire. Based on this information, what does a higher calorific value of a material signify in the context of fire?

a. It will release more heat energy when burned.
b. It is more likely to spontaneously combust at a lower temperature.
c. It indicates that a material is more flammable.
d. It will produce more smoke during combustion.

Cognitive Domain: Knowing	Content Domain: Biology

17. Identical twins, Sarah and Emily, share many physical characteristics. They both have freckles across their nose and blue eyes. Which part of a cell in their bodies most likely determines these shared traits?

a. Mitochondria
b. Centrosome
c. Nucleus
d. Endoplasmic reticulum

Cognitive Domain: Applying	Content Domain: Biology

18. Red blood cells are specialised for efficiently carrying oxygen throughout the body. They lack a nucleus and most organelles, maximising space for haemoglobin, the oxygen-carrying protein. How does this adaptation affect the lifespan of a red blood cell compared to other cells in the body?

a. Red blood cell lifespan will be unaffected.
b. Red blood cells will have a shorter lifespan due to limited protein synthesis.
c. Red blood cells will divide more rapidly to compensate for the lack of a nucleus.
d. Red blood cells will have a longer lifespan due to reduced metabolic activity.

Cognitive Domain: Reasoning	Content Domain: Biology

19. The process of osmosis describes the movement of water across a semipermeable membrane from an area of low solute concentration to an area of high solute concentration. Plant and animal cells were placed in separate beakers containing sugar solutions. The table below shows the sugar concentrations inside the cells and in the surrounding solutions. After some time, it was observed that the animal cells burst, but the plant cells did not.
Which of the following options explains this observation?

	Animal	Plant
Sugar concentration inside cell (M)	0.5	0.2
Sugar concentration in beaker (M)	0.6	0.3

A. Plant cells have a cell wall that provides structural support and prevents them from bursting like animal cells.
B. Animal cells are more sensitive to changes in solute concentration compared to plant cells.
C. Plant cells actively pump out excess water to maintain their internal environment.

a. A only
b. A and B only
c. B and C only
d. A and C only

Cognitive Domain: Knowing	Content Domain: Biology

20. Consider the following statements and choose if they are true or false.

1. The wings of adult insects are simply an enlargement of the structures present on the larva.
2. During metamorphosis in both frogs and insects, some organs are broken down and rebuilt.
3. The adult frog retains a tail, similar to the tail of the tadpole.

a. 1 – True, 2 – True, 3 – False
b. 1 – False, 2 – True, 3 – False
c. 1 – False, 2 – True, 3 – True
d. 1 – True, 2 – True, 3 – True

Cognitive Domain: Applying	Content Domain: Biology

21. Yeast are single-celled organisms that reproduce through a process called budding. Here's what happens during budding:

-A small bud forms on the parent yeast cell.
-The DNA in the parent cell is copied.
-The bud grows and matures.
-The bud separates from the parent cell, becoming a new yeast cell.

During budding, several cellular processes happen. Which of the following does not occur during yeast budding?

a. Cell growth
b. Increase in number of cells
c. Fusion of the genetic material
d. DNA replication

Cognitive Domain: Knowing	Content Domain: Biology

22. Milk left on the counter at room temperature can turn sour and eventually spoil. This souring is caused by bacteria that ferment the milk sugars. These same bacteria are used to make delicious foods like cheese and yoghurt.
What is the key difference between the milk turning sour on the counter and the controlled fermentation used to make cheese or yoghurt?

A. The type of bacteria involved is different.
B. The temperature at which the fermentation occurs is different.
C. Cheese and yoghurt have added salt, which inhibits bad bacteria.

a. A only
b. A and B only
c. B and C only
d. A, B and C

Cognitive Domain: Applying	Content Domain: Biology

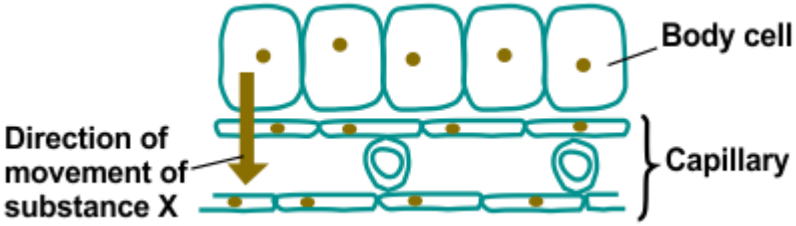
23. Insects, like grasshoppers, have an open circulatory system. Their blood, called haemolymph, bathes their organs directly. Grasshoppers can survive for extended periods without oxygen (anoxia).

Which of the following statements BEST explains how an open circulatory system might be beneficial for an insect's ability to survive anoxia?

a. Haemolymph directly absorbs oxygen from the air.
b. The simpler design of an open system requires less energy.
c. An open system allows for faster oxygen delivery throughout the body.
d. Haemolymph can store more oxygen compared to closed systems.

Cognitive Domain: Reasoning	Content Domain: Biology

24. Scientists are studying the exchange of materials between a body cell and a nearby blood capillary. The following diagram represents this process, with an arrow indicating the movement of a substance X from the capillary to the cell.
Based on the diagram and your understanding of circulatory transport mechanisms, choose the combination of answers that best describes the identity and movement of substance X.



a. Substance X - Oxygen, Movement of substance X - Diffusion
b. Substance X - Glucose and other minerals, Movement of substance X - Osmosis
c. Substance X - CO_2 and waste products, Movement of substance X - Diffusion
d. Substance X - Dissolved nutrients, Movement of substance X - Osmosis

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Cognitive Domain: Knowing	Content Domain: Environmental Science

25. Meteors and comets are both celestial objects. Which of the following statement about them is true?

a. They leave a trail of light in the sky.
b. They have random and unpredictable orbits.
c. They enter the Earth's atmosphere and burn up as shooting stars.
d. They orbit the sun.

Cognitive Domain: Applying	Content Domain: Environmental Science

26. The Moon, Earth's natural satellite, has a very thin atmosphere. This lack of a significant atmosphere affects what happens on the lunar surface. Which of the following is not likely to be observed on the moon?

A. Temperature fluctuations
B. Protection from sun's radiation
C. Formation of craters

a. A only
b. B only
c. A and B only
d. A, B and C

Cognitive Domain: Applying	Content Domain: Environmental Science

27. A public health official is investigating a potential cholera outbreak in a region. Contaminated water is suspected to be the source of the outbreak. Which of the following in the water supply could be harbouring the bacteria that cause cholera?

A. Industrial runoff containing heavy metals
B. Contaminated water with very low levels of chlorine
C. Leakage from sewage systems

a. A only
b. C only
c. B and C only
d. A, B and C

Cognitive Domain: Reasoning	Content Domain: Environmental Science

28. Jenny and her friends explored different locations in the city on their day off and measured the air quality at each spot. The locations visited were:

Location P: Coal factory in the industrial zone
Location Q: Intercity tram and bus station
Location R: A large park on the outskirts of the city known for its botanical gardens.

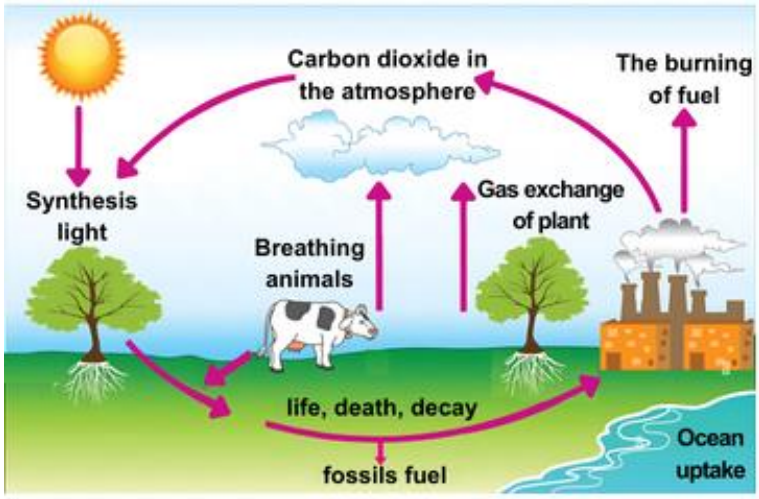
Given below is a table that shows the standard Air quality index (AQI) readings of various categories of air quality. Based on your understanding, predict the MOST LIKELY scenario for the AQI and dominant pollutant at each location (P, Q and R).

a. Location P - 250, SO_2; Location Q - 75, PM; Location R - 30, None
b. Location P - 250, SO_2; Location Q - 75, PM; Location R - 30, None
c. Location P - 350, Ozone; Location Q - 125, VOCs; Location R - 30, CO_2
d. Location P - 160, NOx; Location Q - 160, PM; Location R - 85, Ozone

Cognitive Domain: Applying	Content Domain: Environmental Science

29. The carbon cycle is a crucial process where carbon moves between the atmosphere, living organisms, and the geosphere (Earth's non-living parts) as shown in the diagram below.

Based on the processes depicted identify the statement that is not part of the natural carbon cycle.

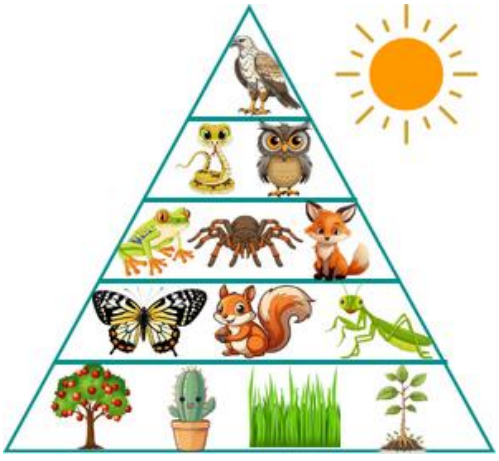


a. Fossil fuels like coal and oil store ancient organic carbon that was buried over millions of years.
b. Plants mainly absorb carbon dioxide from the soil, where organic carbon exists in the form of manure.
c. Both plants and animals release carbon dioxide in the atmosphere as a waste product.
d. Human activities can disrupt the natural balance of the carbon cycle.

Cognitive Domain: Reasoning	Content Domain: Environmental Science

30. Look at the diagram showing an energy pyramid. It represents the flow of energy within an ecosystem. Each level in the pyramid is called a trophic level. The pyramid shows that as energy flows up the levels, only about 10% of the energy is transferred from one level to the next.
Based on the information provided, which of the following statement(s) are correct and represented by the pyramid itself?

A. There's a gradual decrease in population size as you climb the trophic levels.
B. If the primary consumer population booms, they'll shift to the base block of the pyramid.
C. The energy pyramid is applicable solely during daylight hours, specifically when sunlight is available.

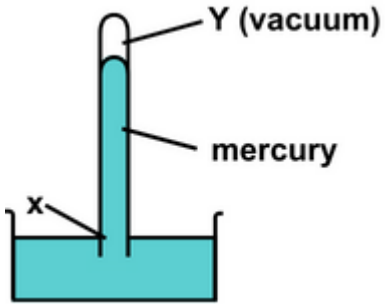


a. A only
b. A and B only
c. A and C only
d. A, B and C

Scholar Section (Each Question is 2 Marks)

Cognitive Domain: Reasoning	Content Domain: Physics

31. The diagram shows a simple mercury barometer which is used to measure atmospheric pressure.
What happens to the pressure at X and Y when atmospheric pressure increases?



a. Pressure at X - Remains the same, Pressure at Y - Remains the same
b. Pressure at X - Remains the same, Pressure at Y - Increases
c. Pressure at X – Increases, Pressure at Y - Increases
d. Pressure at X – Increases, Pressure at Y - Remains the same

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Cognitive Domain: Knowing	Content Domain: Physics

32. A skydiver jumps out of a plane and reaches terminal velocity before deploying their parachute. Considering only the effects of air resistance (a type of friction), what happens to the force of air resistance acting on the skydiver as they fall through the air?

a. The force remains constant throughout the descent.
b. The force increases as the skydiver's speed increases, eventually reaching a maximum value.
c. The force decreases as the skydiver's speed increases.
d. The force fluctuates randomly depending on air currents.

Cognitive Domain: Reasoning	Content Domain: Physics

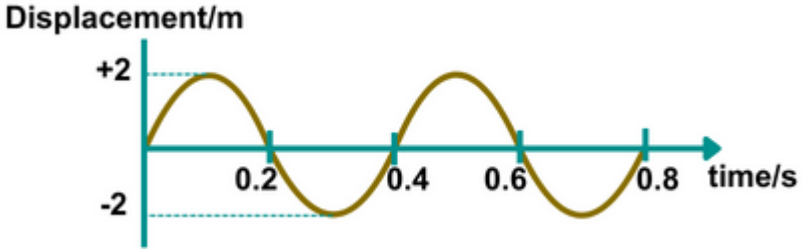
33. Imagine a daring stuntman performing a trick where he lies on a bed of nails. What happens if the number of needles is doubled?

	Force on 1 needle	Force on the man	Pressure at contact
A.	Remains the same	Doubled	Remains the same
B.	Halved	Remains the same	Halved
C.	Remains the same	Doubled	Doubled
D.	Halved	Remains the same	Remains the same

a. A
b. B
c. C
d. D

Cognitive Domain: Applying	Content Domain: Physics

34. The graph represents the displacements of a particle that is along a transverse wave travelling at a speed of 5 m/s.
What is the frequency of the vibration of the particle?



a. 1.25 Hz
b. 2.5 Hz
c. 5 Hz
d. 12.5 Hz

Cognitive Domain: Applying	Content Domain: Chemistry

35. A gold necklace is to be electroplated with a thin layer of silver. The electrolyte solution contains silver nitrate ($AgNO_3$). Which of the following statements is FALSE regarding the electroplating process?

A. The necklace acts as the cathode.
B. Silver ions (Ag^+) are attracted to the cathode and reduced.
C. The mass of the necklace will decrease slightly.
D. A direct current (DC) power source is required.
E. The concentration of silver ions (Ag^+) in the solution decreases near the cathode.

a. Only A
b. Only C
c. Both C and E
d. C, B and E

Cognitive Domain: Reasoning	Content Domain: Chemistry

36. Scientists are exploring a newly discovered planet, X. The average atmospheric temperature on Planet X is -184 °C. They brought samples of various substances along for analysis. The table below shows the melting point and boiling point of these substances in degrees Celsius (°C).
Based on the information, which of the following substances would likely be in a gaseous state on the planet's surface?

Substance	Melting Point (°C)	Boiling Point (°C)	State at Room Temperature
Carbon dioxide (CO_2)	-78.5	-56.6	Gas
Argon (Ar)	-189.19	-185.85	Gas
Iron (Fe)	1538	2862	Solid
Hydrogen (H)	-259.98	-252.87	Gas
Oxygen (0_2)	-218.7	-182.95	Gas
Nitrogen (N_2)	-210	-195.79	Gas
Mercury (Hg)	-38.83	356.73	Liquid

a. CO_2, O_2
b. Ar, H, N_2
c. Ar, H, N_2, O_2
d. Ar, H, N_2, O_2, CO_2

Cognitive Domain: Reasoning	Content Domain: Chemistry

37. Scientists are studying a chemical reaction in a closed container. The reaction is represented by the equation:

$Y(l) + X(s) + Heat \rightarrow 2Z(s) + W(s)$

The goal is to maximise the production of Z and W as quickly as possible.
Based on the information provided, select the option that accurately predicts the nature of the chemical reaction and the factors that can help the scientists change the speed or rate of the reaction to obtain the products faster.

	Nature of the reaction	Factors that can affect the reaction speed
A.	Exothermic	Increasing the temperature of the system
B.	Endothermic	Increasing the concentration of X and Y
C.	Exothermic	Decreasing the temperature of the system
D.	Endothermic	Increasing the pressure of the system

a. A
b. B
c. C
d. D

Cognitive Domain: Reasoning	Content Domain: Biology

38. A group of scientists are studying early embryonic development in humans. They used advanced imaging techniques to observe the development of the embryo within the mother's uterus. The table below summarises their observations at three key stages of development. Based on the information in the table, which of the following identifies the correct stages of embryonic development for X, Y, and Z?

Feature	Stage X	Stage Y	Stage Z
Time frame	Weeks 2-8 (after fertilisation)	Week 9 (after fertilisation)	Week 1 (after fertilisation)
Size	Microscopic to about 1 inch	Up to several inches	Microscopic
Appearance			

a. Stage X - Zygote, Stage Y - Foetus, Stage Z - Embryo
b. Stage X - Zygote, Stage Y - Embryo, Stage Z - Foetus
c. Stage X - Foetus, Stage Y - Zygote, Stage Z - Embryo
d. Stage X - Embryo, Stage Y - Foetus, Stage Z - Zygote

Cognitive Domain: Applying	Content Domain: Biology

39. Bacteria come in various types, and their oxygen needs determine where they thrive.

I. Aerobic bacteria: They require oxygen to survive.
II. Anaerobic bacteria: Thrive in environments with little to no oxygen.
III. Facultative anaerobes: Can survive with or without oxygen.

Correctly identify the bacteria(s) that would be able to survive in the conditions given in the table below.

	Exosphere (atmosphere layer)	Fermenting wine	Infected human lungs
A.	II, III	II, III	I, III
B.	II	III	I
C.	I, III	II, III	II, III
D.	II, III	II, III	II, III

a. A
b. B
c. C
d. D

Direction (for questions 40 to 41): The excerpt below is taken from a newspaper. Carefully read through the passage and answer the following questions.

Hilltown Herald, May 14, 2024

In a dramatic turn of events late last night, the Hilltop Warehouse on the outskirts of Hilltown caught fire, sending up plumes of dense smoke visible from miles away. The fire, which erupted around 11 PM, quickly escalated, fuelled by a mix of various substances stored within the facility.

Preliminary reports from the fire department suggest that the blaze originated in a section of the warehouse storing large quantities of paper products. The presence of these materials significantly contributed to the rapid spread of the fire. Nearby, several drums containing petroleum-based solvents intensified the flames further. Additionally, the warehouse stored

lumber, adding another combustible element to the inferno. Wood, while having a higher ignition temperature than paper, can contribute significantly to a fire's intensity due to its ability to sustain a flame for longer durations.

According to Chief Fire Officer Linda Grey, the conditions on the night of the fire were unusually conducive to such a disaster. "The air was dry with low humidity levels, and a steady breeze helped the flames to propagate faster than usual," she explained.

Firefighting efforts were hampered by the lack of immediate access to large water sources, highlighting the challenges in controlling fires in such infrastructures. The table below summarises the key elements found at the scene.

This incident serves as a stark reminder of the need for stringent safety protocols, especially regarding the storage and management of combustible materials. Investigations are ongoing, and updates will follow as more details become available.

Material	Ignition Temperature (°C)	Calorific Value (kJ/kg)
Paper	233	16,000
Petroleum Solvents	210	45,000
Wood	300	18,000

Cognitive Domain: Applying	Content Domain: Chemistry

40. Considering the described environmental conditions and materials involved in the Hilltop Warehouse fire, predict the changes in fire behaviour if there had been no breeze and the environment was more humid on the night of the fire.

A. The paper products would have been more resistant to ignition due to higher moisture content.
B. The high calorific value materials would have burned less efficiently.
C. The intense heat from the fire would have caused a significant rise in humidity.

a. A only
b. A and B only
c. B and C only
d. A, B and C

Cognitive Domain: Reasoning	Content Domain: Chemistry

41. Considering the information in the passage about the Hilltop Warehouse fire, analyse the materials and their properties to determine how each material likely influenced the fire's behaviour. Which of the following options correctly describes the role of each material?

	Paper	Petroleum Solvents	Wood
A.	Accelerant	Primary fuel	Secondary fuel
B.	Secondary fuel	Accelerant	Primary fuel
C.	Primary fuel	Accelerant	Secondary fuel
D.	Accelerant	Secondary fuel	Primary fuel

a. A
b. B
c. C
d. D

Direction (for questions 42 to 43): Carefully read through the passage and answer the following questions.

Fight or Flight Chemistry

Imagine yourself in a dangerous situation. Your heart pounds, your breath quickens, and you feel a surge of energy. This isn't just fear; it's your body's built-in defence system kicking in. Adrenaline, a hormone produced in the adrenal glands, plays a starring role in this reaction.

Adrenaline acts like a chemical messenger. When faced with danger, the nervous system triggers the adrenal glands to release a surge of adrenaline into the bloodstream. This triggers a cascade of effects throughout the body, prepping you for action. Blood flow is redirected towards muscles, increasing strength and stamina. Your pupils dilate, sharpening your vision. Even your airways open wider, allowing for more oxygen intake.

But how does adrenaline achieve these effects? Think of it like unlocking a cellular power-up. Adrenaline binds to receptors on cells, prompting them to convert stored energy (glucose) into readily available fuel. This fuels the physical responses we associate with the "fight-or-flight" response – the burst of energy to outrun a threat or the surge of strength to fight back. However, this surge comes at a cost. The constant presence of high adrenaline levels can put strain on the heart and nervous system. Once the danger has passed, the body works to return to a balanced state, gradually lowering adrenaline levels.

So, the next time you feel that adrenaline rush, remember it's a marvel of hormonal chemistry, a primal response fine-tuned by evolution to help you survive.

Cognitive Domain: Applying	Content Domain: Biology

42. The passage describes adrenaline causing pupils to dilate during a dangerous situation. Why might this be advantageous?

a. Widens the field of view for a broader visual awareness.
b. Enables better night vision in low-light conditions.
c. Allows for increased tear production to lubricate the eyes.
d. Protects the eyes from bright light.

Cognitive Domain: Applying	Content Domain: Biology

43. You're walking home alone when you see a large, aggressive dog approaching. Your body prepares for action. Which of the following best represents the order of events when facing danger, according to the passage?

a. Increased heart rate → danger detected → adrenaline released
b. Nervous system triggers adrenal glands → adrenaline released → increased heart rate
c. Adrenaline released → danger detected → nervous system triggered
d. Danger detected → adrenaline production → nervous system activation

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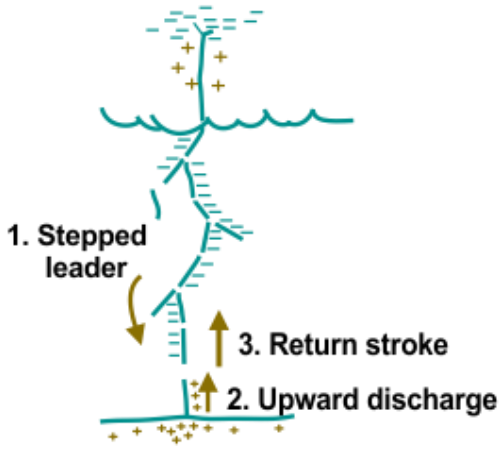
Direction (for questions 44 to 45): Carefully read through the passage and answer the following questions.

Nature's Electric Spark

Lightning is a dazzling display of electrical fury, but have you ever wondered how a cloud produces such a powerful jolt? It all begins with the movement of air within a thunderstorm. Updrafts carry water vapor high into the atmosphere, where it condenses and forms ice crystals. Collisions between these crystals create a static charge separation, with positive charges accumulating near the top of the cloud and negative charges concentrated at the base.

As the charge imbalance intensifies, the air, normally a good insulator, can no longer contain the electrical pressure. A burst of electricity, called a stepped leader, shoots downward in a zigzag path, seeking a path to the ground or opposing charges within the cloud. This leader ignites a return stroke, a powerful surge of electricity that travels back up the channel, illuminating the path we see as lightning. The immense heat generated by the lightning stroke can even briefly split the air molecules, creating the booming sound of thunder we hear after the flash.

By understanding the electrical properties of air, the role of moving air masses, and the concept of charge separation, we can not only appreciate the science behind lightning but also recognise the important role it plays in atmospheric processes.



Cognitive Domain: Knowing	Content Domain: Environmental Science

44. The passage mentions lightning as a crucial part of atmospheric processes. Beyond the visual spectacle, what alternative benefit might lightning provide to the atmosphere on a larger scale?

a. It purifies the air by breaking down harmful pollutants into harmless compounds.
b. It triggers chemical reactions that create essential greenhouse gases for the planet.
c. It disrupts weather patterns, leading to more frequent but less severe storms.
d. It helps fix nitrogen from the atmosphere, making it available for plant growth.

Cognitive Domain: Applying	Content Domain: Environmental Science

45. The passage describes a stepped leader as the initial electrical discharge seeking a path. This stepped leader doesn't take a straight path but moves in steps or branches. Why might that be more advantageous for a lightning strike compared to a direct, straight downward path?

a. It allows the stepped leader to explore multiple potential paths for the most efficient discharge.
b. Lightning always travels in a stepped pattern, never in a straight line.
c. It ensures the lightning reaches the most negatively charged area on the ground.
d. The zigzag path helps dissipate the electrical energy more gradually.

Answer Key

1.	a	**2.**	c	**3.**	d	**4.**	c	**5.**	d	**6.**	b	**7.**	c
8.	c	**9.**	b	**10.**	a	**11.**	c	**12.**	d	**13.**	a	**14.**	c
15.	d	**16.**	a	**17.**	c	**18.**	d	**19.**	a	**20.**	b	**21.**	c
22.	d	**23.**	b	**24.**	c	**25.**	d	**26.**	b	**27.**	c	**28.**	a
29.	b	**30.**	a	**31.**	d	**32.**	b	**33.**	b	**34.**	d	**35.**	b
36.	b	**37.**	b	**38.**	d	**39.**	a	**40.**	b	**41.**	c	**42.**	a
43.	b	**44.**	d	**45.**	a								