UNICUS OLYMPIADS

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Sample Paper

Class 9

Unicus Global Science Olympiad (UGSO)

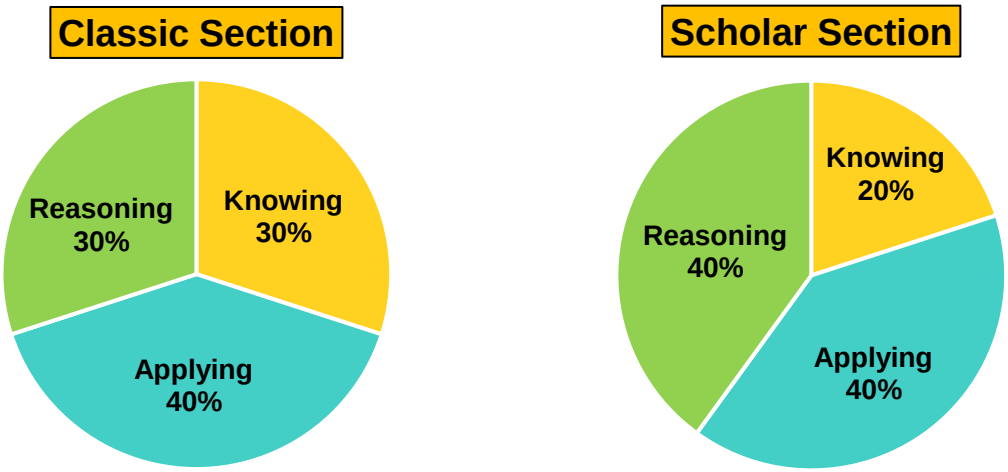
Time: 60 minutes

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

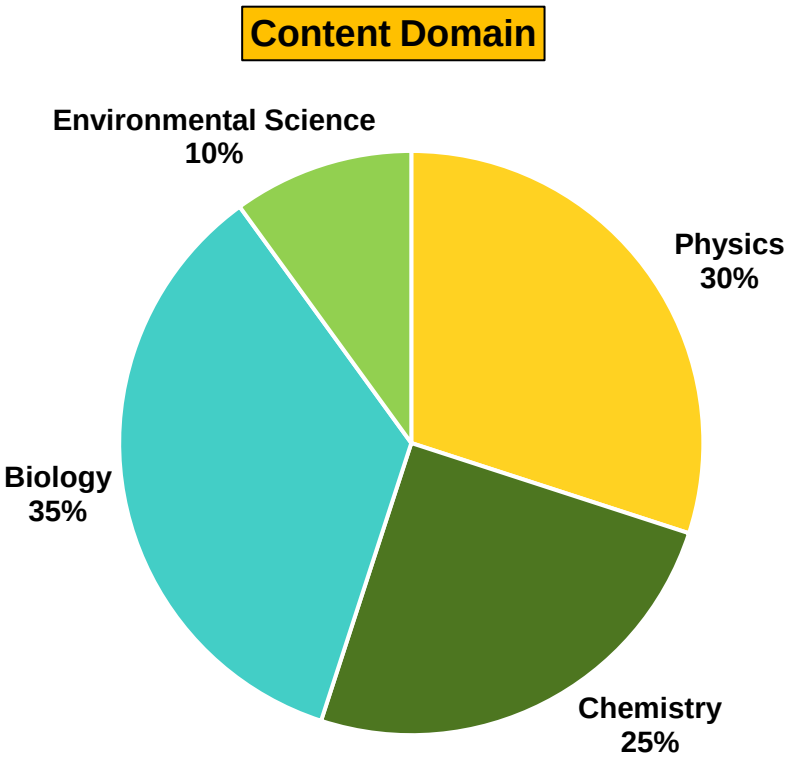
The **Unicus Global Olympiad** is organised around two dimensions:

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 content and 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)

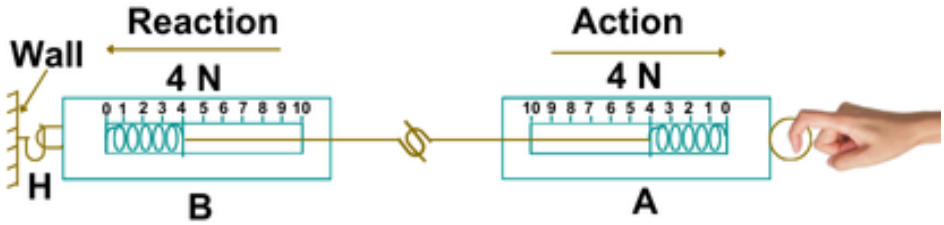
Cognitive Domain: Applying	Content Domain: Physics

1. A train is moving at a constant speed of 60 km/h on a straight track. A passenger walks from the rear end of the train to the front at a speed of 5 km/h relative to the train. Using the reference point of the ground, what is the passenger's speed relative to the ground?

a. 5 km/h
b. 55 km/h
c. 60 km/h
d. 65 km/h

Cognitive Domain: Knowing	Content Domain: Physics

2. During a physics class, your teacher demonstrates Newton's Third Law of Motion by using a pair of spring balances attached to each other. When one spring balance is pulled, the other one shows the same reading but in the opposite direction.
What principle does this activity illustrate, and how does it relate to Newton's Third Law of Motion?



a. This activity illustrates that for every action, there is an equal and opposite reaction, as demonstrated by the equal and opposite forces shown on the spring balances.
b. This activity illustrates that the force applied by one spring balance is less than the force shown on the other.
c. This activity illustrates that the forces are unbalanced, causing the spring balance to show different readings.
d. This activity illustrates that the forces are not related and act independently.

Cognitive Domain: Applying	Content Domain: Physics

3. In a physics lab, a student has a cart with an unknown mass and a sensor that can measure not only the force applied but also the friction acting on the cart. The student applies a constant force of 30 N to the cart and measures an acceleration of 3 m/s². The sensor also detects a frictional force of 5 N acting in the opposite direction of the applied force. Calculate the mass of the cart using this data.

a. 5 kg
b. 11.66 kg
c. 8.33 kg
d. 50 kg

Cognitive Domain: Reasoning	Content Domain: Physics

4. A truck of mass 2000 is moving at a velocity of 10 m/s when it collides with a stationary car of mass 1000 kg. After the collision, the truck continues to move in the same direction but at a reduced speed of 6 m/s.
What would be the velocity of the car immediately after the collision?

a. 4 m/s
b. 6 m/s
c. 8 m/s
d. 10 m/s

Cognitive Domain: Knowing	Content Domain: Physics

5. A satellite is intended to be placed into a stable circular orbit around Earth at a specific altitude. To achieve and maintain this stable orbit, which of the following factors must be correctly adjusted and monitored?

a. The mass of the satellite
b. The velocity of the satellite
c. The shape of the satellite
d. The size of the satellite

Cognitive Domain: Applying	Content Domain: Physics

6. An astronaut who weighs 700 N on Earth travels to a planet where the acceleration due to gravity is one-third that of Earth's. Calculate the astronaut's new weight based on the given conditions.

a. 2100 N
b. 700 N
c. 233.33 N
d. 233.33 Kg

Cognitive Domain: Reasoning	Content Domain: Physics

7. Considering two planets, X and Y, with equal masses, if planet X has a radius twice that of planet Y, what can be said about the gravitational force experienced by objects on the surfaces of these planets?

a. Objects on X experience one-fourth the gravitational force experienced on Y.
b. Objects on X experience half the gravitational force experienced on Y.
c. Objects on X experience the same gravitational force as on Y.
d. Objects on X experience twice the gravitational force experienced on Y.

Cognitive Domain: Reasoning	Content Domain: Physics

8. A child pulls a toy car with a string at an angle of 30° to the horizontal ground. The force applied by the child is 5 N, and the toy car moves 3 metres horizontally. Calculate the work done by the force in the direction of motion.

a. 7.5 Joules
b. 12.99 Joules
c. 15 Joules
d. 50 Joules

Cognitive Domain: Applying	Content Domain: Physics

9. A sound wave is emitted towards a large wall 200 metres away and the echo is heard 1.2 seconds after the sound was emitted. Calculate the speed of sound based on this information and compare it with the given table to identify the temperature conditions in which the experiment was conducted.

Temperature (°C)	Speed of Sound (m/s)
0	331.3
10	340.3
20	333.4
30	346.4

a. 0°C
b. 10°C
c. 20°C
d. 30°C

Cognitive Domain: Reasoning	Content Domain: Physics

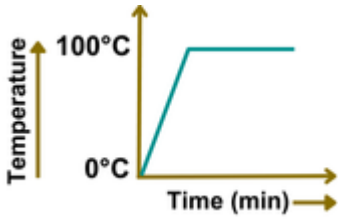
10. A sound wave travels through water at a speed of 1480 m/s. If the frequency of the sound wave is 500 Hz, calculate the wavelength of the sound wave in water. Additionally, if this sound wave enters the air where the speed of sound is 343 m/s, what will be the new frequency and wavelength of the sound wave in the air?

	λ_{water}	λ_{air}	ν
A	2.96 m	0.686 m	500 Hz
B	3 m	0.686 m	500 Hz
C	2.96 m	1 m	343 Hz
D	2.96 m	4.3 m	500 Hz

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

Cognitive Domain: Knowing	Content Domain: Chemistry

11. A student heats a beaker containing ice and water. He measures the temperature of the content of the beaker as a function of time. Which of the following would correctly represent the result?

a.


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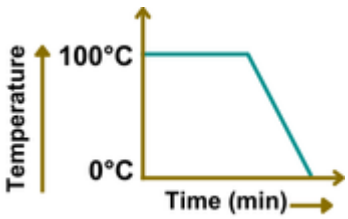
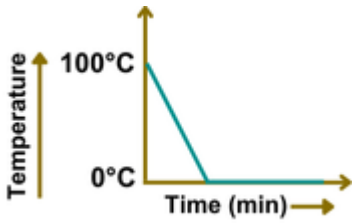


c.


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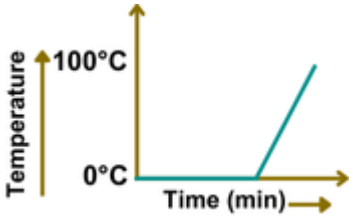


Cognitive Domain: Knowing	Content Domain: Chemistry

12. Given below are a few methods and processes associated with them. From the different combinations in the options choose the correct one.

I. Dry ice is kept at room temperature and one atmospheric pressure.
II. A drop of ink placed on the water's surface contained in a glass spread throughout the water.
III. An acetone bottle is left open and the bottle becomes empty.
IV. Milk is churned to separate cream from it.

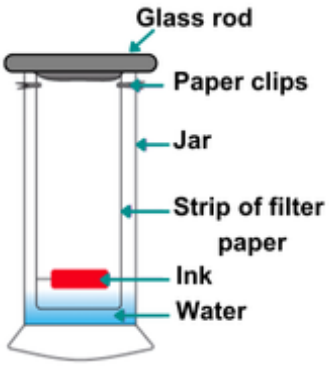
	I	II	III	IV
A	Sublimation	Diffusion	Evaporation	Centrifugation
B	Evaporation	Diffusion	Sublimation	Centrifugation
C	Sublimation	Osmosis	Evaporation	Distillation
D	Condensation	Dispersion	Sublimation	Centrifugation

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

Cognitive Domain: Applying	Content Domain: Chemistry

13. A child wanted to separate the mixture of dyes constituting an ink sample. He marked a line with the ink on the filter paper and placed the filter paper in a glass containing water, as shown in the figure. The filter paper was removed when the water moved near the top of the filter paper.
After experimenting, the child observed three distinct spots of different colours on the filter paper. However, upon repeating the experiment with a different ink sample, only two spots were visible, and one of them was significantly faint compared to the other.

What could be the most likely reason for observing only two spots, and what does this imply about the properties of the components in the second ink sample?



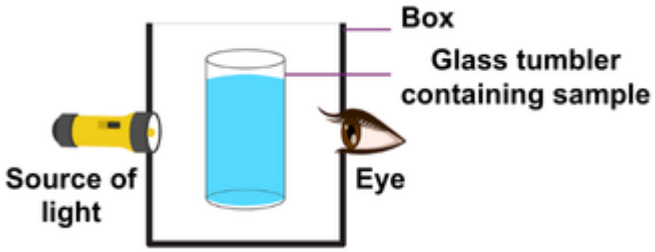
a. The second ink sample has fewer dye components, which explains the presence of only two spots, and the faint spot indicates a lower concentration of one dye.
b. The second ink sample might contain a component that is less soluble in water, resulting in a faint spot, and another component that does not separate under these conditions.

c. The water used in the second experiment had impurities that affected the separation process, leading to incomplete separation and faint spots.
d. The paper used in the second experiment has a different texture, causing uneven absorption and separation, resulting in a faint spot.

Cognitive Domain: Reasoning	Content Domain: Chemistry

14. A group of students took an old shoe box and covered it with black paper from all sides. They fixed a source of light (a torch) at one end of the box by making a hole in it and making another hole on the other side to view light. They placed a milk sample contained in a beaker in the box as shown in the figure. They were amazed to see that milk taken in the tumbler was illuminated. They tried the same activity by taking a salt solution but found that light simply passed through it.

Why was the milk sample illuminated while the salt solution was not, and what does this indicate about the milk sample?



a. The milk is a colloid, scattering light, while the salt solution is a true solution that doesn't scatter light.
b. The milk has larger molecules that absorb and re-emit light, unlike the smaller ions in the salt solution.
c. The milk is an emulsion that reflects light, whereas the salt solution is homogeneous and doesn't reflect light.
d. The milk contains impurities that scatter light, while the salt solution is pure and allows light to pass through.

Cognitive Domain: Applying	Content Domain: Chemistry

15. The ratio of the radii of the hydrogen atom and its nucleus is around 100,000. Assuming the atom and the nucleus to be spherical, what will be the ratio of their sizes?

a. 10
b. 10000
c. 100
d. 10^{15}

Cognitive Domain: Knowing	Content Domain: Chemistry

16. An alpha particle is directed at a thin gold foil and observed to pass through with minimal deflection. What can be inferred about the structure of the atom from this observation?

a. Neutrons cause the deflection.
b. The positive charge is uniformly distributed.
c. Electrons are located within the nucleus.
d. Atoms are mostly empty space.

Cognitive Domain: Reasoning	Content Domain: Chemistry

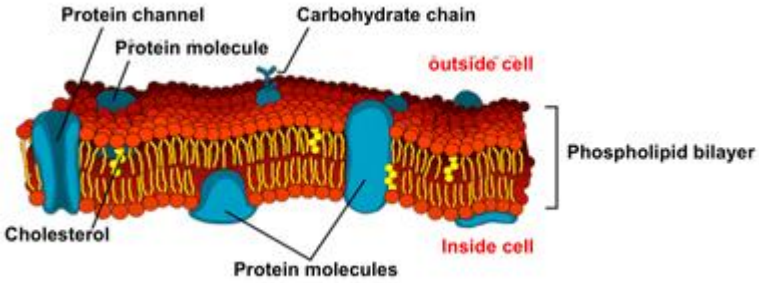
17. Given the table, identify which elements are isobars and explain why?

Element	Protons	Neutrons	Mass Number
K	19	21	40
Ca	20	20	40
Ar	18	22	40
Cl	17	23	40

a. Ar and Cl are isobars because they have the different neutron and different proton counts.
b. K and Ar are isobars because they have the same mass number and different neutron count.
c. Ca and Cl are isobars because they have different mass numbers and this criterion is enough for them to be called isobars.
d. K and Ca are isobars because they have the same mass number but different proton counts.

Cognitive Domain: Knowing	Content Domain: Biology

18. Based on the given diagram of the cell membrane, identify which component is primarily responsible for the selective permeability of the plasma membrane.



a. Phospholipid bilayer
b. Integral proteins
c. Carbohydrate chains
d. Cholesterol molecules

Cognitive Domain: Applying	Content Domain: Biology

19. Two solutions are separated by a semi-permeable membrane. Solution A has a higher concentration of solute compared to Solution B. Based on your understanding, predict the movement of water molecules and the resulting effect on the cells in Solution B.

Solution	Solute Concentration	Water Movement
A	High	?
B	Low	?

a. Water will move from A to B, causing cells in B to swell.
b. Water will move from B to A, causing cells in B to shrink.
c. Solute will move from A to B, causing cells in B to swell.
d. The solute will move from B to A, causing cells in B to shrink.

Cognitive Domain: Reasoning	Content Domain: Biology

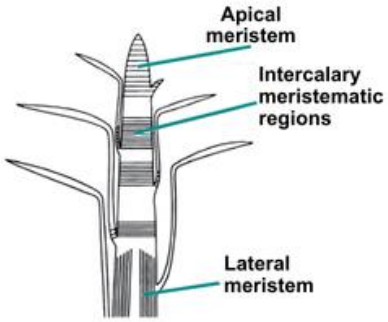
20. Given the following data on the movement of molecules inside a cell membrane, determine which type of transport is most likely occurring. The table shows the concentration of molecule X inside and outside the cell and the presence of ATP during the transport process.

Inside the Cell	Outside the Cell	Presence of ATP
5 mM	1 mM	Yes

a. Diffusion
b. Osmosis
c. Active transport
d. Facilitated diffusion

Cognitive Domain: Applying	Content Domain: Biology

21. If a plant's lateral meristems are damaged, which of the following outcomes is most likely to occur? Consider the role of lateral meristems in plant growth and development, and how their impairment would affect the plants' physical structure.



a. The plant will stop growing in length, affecting its overall height and reach.
b. The plant will stop growing in thickness, leading to a thinner, potentially weaker structure.
c. The plant will be unable to produce new leaves, impacting photosynthesis and energy production.
d. The plant will be unable to transport water and nutrients effectively, leading to overall wilting and nutrient deficiency.

Cognitive Domain: Reasoning	Content Domain: Biology

22. A young athlete has been diagnosed with a connective tissue disorder that affects collagen fibres. Given that collagen provides strength and support in various tissues, which type of connective tissue is most likely to be compromised, leading to joint instability and frequent injuries?

a. Loose connective tissue, which is mainly involved in cushioning and supporting organs.
b. Dense connective tissue, which provides firm connections in tendons and ligaments.
c. Fluid connective tissue, which includes blood and lymph is responsible for transport and immune functions.
d. Supportive connective tissue, which includes cartilage and bone, provides structural support.

Cognitive Domain: Knowing	Content Domain: Biology

23. Which phylum of animals is characterised by the absence of a true coelom, a cylindrical body shape, and includes both free-living and parasitic species?

a. Nematoda
b. Mollusca
c. Arthropoda
d. Annelida

Cognitive Domain: Knowing	Content Domain: Biology

24. Which type of immunity is established when a significant portion of a population is immune to a disease, either through vaccination or previous infection, thus limiting the spread of the disease?

a. Active immunity
b. Passive immunity
c. Innate immunity
d. Herd immunity

Cognitive Domain: Applying	Content Domain: Biology

25. In a biology class, students are learning about the chain of infection. The teacher asks a question related to the role of the 'reservoir' in the chain of infection.
What is the primary function of a 'reservoir' in the transmission of infectious diseases?

a. It is the initial entry point of the pathogen into the host.
b. It is the immune response generated by the host against the pathogen.
c. It is the environment where the pathogen survives and multiplies.
d. It is the vector that transmits the pathogen from one host to another.

Cognitive Domain: Knowing	Content Domain: Biology

26. The waste hierarchy is a framework for prioritising waste management practices. The terms given below represent different stages of the hierarchy. Rank the following stages from MOST to LEAST preferable, considering environmental impact.
Stages: Landfill disposal, recycling, waste prevention, and waste incineration

a. Waste prevention > Recycling > Waste incineration > Landfill disposal
b. Waste incineration > Recycling > Waste prevention > Landfill disposal
c. Landfill disposal > Waste prevention > Recycling > Waste incineration
d. Recycling > Landfill disposal > Waste prevention > Waste incineration

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Cognitive Domain: Applying	Content Domain: Biology

27. To determine the best material for biodegradable packaging, a company tests four different types of natural materials in a controlled composting environment: banana leaves, corn husks, thick sheets of paper, and coconut shells. After eight weeks, which material is likely to decompose the fastest, and why?

a. Banana leaves, because they are thin and decompose quickly.
b. Corn husks, because they are organic and break down easily.
c. Paper, because it is processed and absorbs moisture well.
d. Coconut shells, because they are natural and provide nutrients.

Cognitive Domain: Reasoning	Content Domain: Biology

28. A group of environmental scientists experimented to assess the effectiveness of different waste management techniques in reducing the environmental impact of solid waste. They collected data over several months and analysed the results. Based on their findings, they concluded that one method stood out as the most environmentally sustainable.

Which of the following waste management techniques is most likely to have been identified as the most environmentally sustainable by the scientists?

a. Dumping waste in oceans or rivers
b. Burying all recyclable materials along with general waste
c. Incineration of all waste to generate electricity
d. Vermicomposting waste to create fertiliser

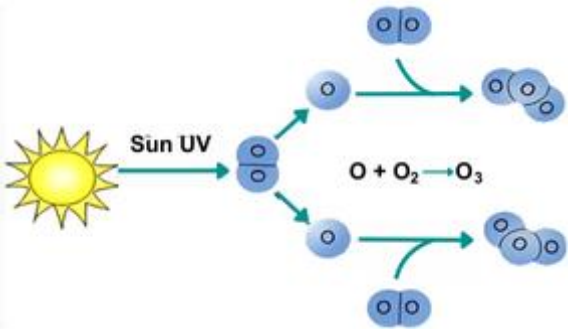
Cognitive Domain: Applying	Content Domain: Environmental Science

29. A farmer in an area prone to soil erosion due to heavy rainfall wants to adopt a cropping pattern that helps mitigate erosion and maintain soil fertility. After consulting with agricultural experts, the farmer learns about different cropping patterns and their impacts on soil health. Which cropping pattern should the farmer choose?

a. Monocropping
b. Mixed Cropping
c. Intercropping
d. Crop Rotation

Cognitive Domain: Applying	Content Domain: Environmental Science

30. Study the provided diagram of the ozone layer and its formation. The diagram indicates how ozone is formed by the action of UV radiation on oxygen molecules. Which of the following human activities has the most direct negative impact on the ozone layer, and why?



a. Deforestation, because it reduces the number of trees available for photosynthesis.
b. Emission of chlorofluorocarbons (CFCs), because they release chlorine atoms that destroy ozone molecules.
c. Burning of fossil fuels releases carbon dioxide into the atmosphere.
d. Agricultural runoff, because it leads to water pollution.

Scholar Section (Each Question is 2 Marks)

Cognitive Domain: Reasoning	Content Domain: Physics

31. Consider two cars, A and B, both moving along a straight road. Car A is initially at rest and Car B is moving at a constant speed. Suddenly, Car A starts accelerating at 2 m/s². If Car B continues at a constant speed of 10 m/s, at what time will Car A overtake Car B if Car B is initially 20 metres ahead?

a. 2 s
b. 4 s
c. 11 s
d. 20 s

Cognitive Domain: Knowing	Content Domain: Physics

32. Consider the following statements about the work-energy theorem:

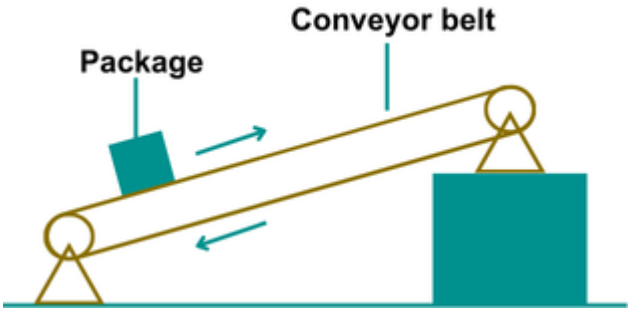
1. The work-energy theorem states that the net work done on an object is equal to its change in kinetic energy.
2. For an object moving in a circular path at a constant speed, the net work done over one complete revolution is zero.
3. The work done by a non-conservative force is equal to the change in mechanical energy of the system.
4. The work-energy theorem can only be applied to translational motion, not rotational motion.

Which of the above statements are true?

a. 1 and 2
b. 2 and 3
c. 1 and 3
d. 3 and 4

Cognitive Domain: Applying	Content Domain: Physics

33. A conveyor belt lifts packages from the ground to a height of 8 metres at a rate of 4 packages per minute. Each package has a mass of 10 kg.
Calculate the power required to lift the packages.



a. 40 W
b. 60.6 W
c. 52.3 W
d. 7.5 W

Cognitive Domain: Knowing	Content Domain: Chemistry

34. Match elements given in Column A with their respective atomic properties given in Column B.

	Column A (Elements)		Column B (Clues)
(i)	Oxygen	(A)	
(ii)	Neon	(B)	
(iii)	Potassium	(C)	
(iv)	Hydride ion	(D)	
(v)	Fluorine	(E)	

a. i: B; ii: A; iii: E; iv: D; v: C
b. i: B; ii: E; iii: A; iv: C; v: D
c. i: B; ii: A; iii: E; iv: C; v: D
d. i: D; ii: A; iii: E; iv: C; v: B

Cognitive Domain: Reasoning	Content Domain: Chemistry

35. In a laboratory experiment, a naturally occurring sample of chlorine was found to contain 75.78% of Cl-35 with a mass of 34.969 amu and 24.22% of Cl-37 with a mass of 36.966 amu.
Calculate the average atomic mass of the chlorine atoms present in the sample.

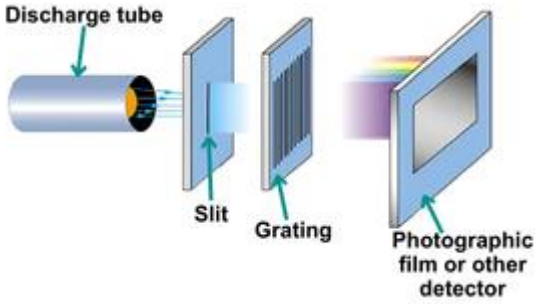
a. 32.45 amu
b. 34.96 amu
c. 35.48 amu
d. 36.25 amu

Cognitive Domain: Applying	Content Domain: Chemistry

36. In an experiment to investigate the validity of Bohr's Atomic Model, scientists observed the emission spectrum of hydrogen gas excited by an electrical discharge. The setup involved passing an electric current through a tube containing hydrogen gas and analysing the resulting spectrum. The observations made during the experiment are as follows:

1. The spectrum displayed distinct, discrete lines of different colours.
2. Each line in the spectrum corresponds to a specific wavelength of light.
3. The wavelengths of the emitted light were found to be inversely proportional to the energy differences between the electron orbits.

Based on these observations, which inferences are correct?



a. The experiment directly measures the size of electron orbits.
b. Electrons continuously radiate energy as they orbit the nucleus.
c. The observed spectrum validates the existence of neutrons in the hydrogen atom.
d. Electrons can exist only in specific allowed energy levels in hydrogen atoms.

Cognitive Domain: Applying	Content Domain: Biology

37. Imagine you are a biologist researching a remote island. During your expedition, you discover a new species of plant with unique characteristics. To classify this plant accurately, you decide to use modern classification criteria. Based on the information provided, which characteristics would you consider to determine the classification of this new plant species?

A. The presence or absence of specialised vascular tissues
B. The number of cotyledons (seed leaves) in the seed
C. The plant's reproductive strategy

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

Cognitive Domain: Reasoning	Content Domain: Biology

38. Based on the provided data showing the distribution of cardiovascular disease patients across different age groups, which age group exhibits the lowest percentage of patients diagnosed, considering the population distribution in each age category as given?

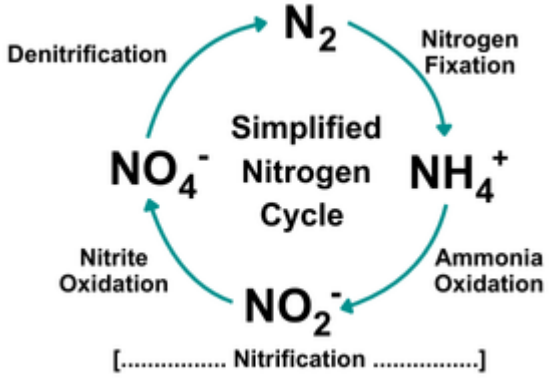
Age Group	Population
0-20	500
21-40	1000
41-60	1500
61-80	1200
81-100	800

Age Group	Cardiovascular Disease Patients
0-20	15
21-40	35
41-60	75
61-80	100
81-100	20

a. 0-20
b. 21-40
c. 41-60
d. 61-80

Cognitive Domain: Reasoning	Content Domain: Environmental Science

39. The nitrogen cycle is a biogeochemical process that transforms the inert nitrogen present in the atmosphere into a more usable form for living organisms. Considering the stages of the nitrogen cycle described, which process is most likely to occur in water-logged soils and why?



a. Nitrogen fixation, because it converts atmospheric nitrogen into usable forms.
b. Nitrification, because it involves converting ammonium ions into nitrates.
c. Denitrification, because it occurs in low-oxygen environments, like water-logged soils.
d. Assimilation, because plants take up nitrates and ammonium ions.

Direction (for questions 40 to 41): Consider the passage given below and answer the following question:

Plasma and Unconventional States of Matter

Plasma, often termed the fourth state of matter, is an ionised state in which atoms are stripped of their electrons, resulting in a mixture of free electrons and ions. This high-energy state is distinct from solids, liquids, and gases, exhibiting unique properties due to the presence of charged particles. Plasma forms under extremely high temperatures or strong electromagnetic fields, conditions that provide sufficient energy to overcome the forces holding electrons to nuclei.

Natural examples of plasms include stars, where nuclear fusion occurs, and lightning, where intense energy ionises air molecules. In technology, plasma is utilised in applications such as fluorescent lights, plasma screens, and in the field of nuclear fusion research, which aims to replicate the energy production of stars on Earth.

One of the defining characteristics of plasma is its ability to conduct electricity, a consequence of its charged particle composition. This conductivity allows plasma to respond to magnetic fields, enabling control and confinement in devices like tokamaks used for fusion research. Additionally, plasma can emit light, a property exploited in neon signs and plasma displays. The interactions between charged particles in plasma also give rise to complex behaviours, such as the formation of plasma waves and instabilities, which require advanced mathematical and physical theories to understand and predict. The study of plasma physics not only advances our knowledge of the universe but also holds the potential for revolutionary energy solutions through controlled nuclear fusion.

Cognitive Domain: Applying	Content Domain: Chemistry

40. Based on the passage, why might a detailed understanding of the light-emitting properties of plasma be crucial for advancements in plasma screen technology?

A. To enhance the brightness and clarity of the displays.
B. To reduce the energy consumption of the screens.
C. To increase the lifespan of the plasma displays.
D. To enable the screens to function at lower temperatures.

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

Cognitive Domain: Reasoning	Content Domain: Chemistry

41. Based on the passage, what would happen to the electrical conductivity of plasma in a tokamak if the researchers:

I. Decrease the temperature of the plasma
II. Increase the magnetic field strength
III. Reduce the ionisation

a. I: increase; II: decrease; III: increase
b. I: increase; II: decrease; III: decrease
c. I: decrease; II: increase; III: decrease
d. I: increase; II: increase; III: decrease

Directions (for questions 42 to 43): Consider the passage given below and answer the following question:

Plant-Animal Interactions

In the intricate relations of ecosystems, mutualistic relationships between plants and animals play a pivotal role in shaping the natural world. These symbiotic interactions. Characterised by mutual benefits for both parties involved, often involves specialised adaptations that enhance the survival and reproductive success of both partners.

One striking example of mutualism can be observed in the relationship between certain species of yucca moths (Tegeticula spp.). Yucca plants, with their towering stalks of fragrant flowers, rely on yucca moths for pollination. Female yucca moths, equipped with specialised mouthparts known as "tentacles," collect pollen from yucca flowers and transfer it to the stigma of the other flowers as they lay their eggs. In return, yucca moth larvae feed on a portion of the developing seeds within the pollinated flowers, ensuring their survival.

This intricate dance of cooperation and co-dependence underscores the remarkable adaptations that have evolved over millions of years of co-evolution. By understanding the intricacies of mutualistic relationships, we gain insight into the delicate balance that sustains life on Earth.

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Cognitive Domain: Applying	Content Domain: Biology

42. How might the extinction of yucca moths impact the yucca plants in the ecosystem?

a. Yucca plants would experience a decrease in seed production due to a lack of pollination.
b. Yucca plants would thrive as they would no longer have to share resources with the moths.
c. Yucca plants would become more resilient to environmental changes.
d. Yucca plants would switch to wind pollination to compensate for the absence of moths.

Cognitive Domain: Reasoning	Content Domain: Biology

43. If a new species were to emerge in the ecosystem where yucca plants and yucca moths coexist, which of the following scenarios would most likely disrupt the mutualistic relationship between yucca plants and yucca moths?

A. The predator species primarily prey on yucca moth larvae, reducing their population size and reproductive success.
B. A herbivore species primarily eats yucca plants, leading to a decrease in yucca plant population density.
C. The predator species primarily prey on other insect pollinators, causing a decrease in overall pollination rates within the ecosystem.

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

Directions (for questions 44 to 45): Consider the passage given below and answer the following question:

Revolutionising Agriculture Through Innovation

In the quest for sustainable agriculture, innovation emerges as a catalyst for transformative change, ushering in a new era of farming practices that prioritise environmental stewardship alongside productivity. From genetic engineering to precision framing technologies, a plethora of innovations are reshaping the agricultural landscape, offering novel solutions to age-old challenges.

Biotechnology, epitomised by genetic modification, holds immense promise in enhancing crop resilience and mitigating yield losses attributed to pests, diseases, and adverse environmental

conditions. By introducing genes conferring traits such as pest resistance, drought tolerance, and enhanced nutrient uptake, genetically modified crops offer a pathway towards sustainable intensification, where yields soar while ecological footprints diminish. Despite controversies surrounding genetically modified organisms (GMOs), proponents argue that judicious deployment of biotechnology can unlock untapped potential in agricultural sustainability, paving the way for a future where food security coexists with environmental harmony.

In addition to genetic engineering, precision agriculture has revolutionised modern farming. Precision agriculture uses advanced technologies like GPS mapping, remote sensing and data analytics to optimise crop management. Variable rate technology (VRT) allows for precise application of water, fertilisers, and pesticides, minimising waste and environmental impact.

Cognitive Domain: Knowing	Content Domain: Environmental Science

44. How might the judicious deployment of biotechnology, particularly genetic modification, contribute to sustainable agriculture, as discussed in the passage?

a. By reducing the need for chemical pesticides, thereby minimising environmental pollution.
b. By increasing crop yields through the introduction of genes for pest resistance and drought tolerance.
c. By promoting the use of organic farming methods to enhance soil fertility and biodiversity.
d. By advocating for stricter regulations on genetically modified organisms to protect consumer health.

Cognitive Domain: Applying	Content Domain: Environmental Science

45. Researchers compared the impact of traditional farming (Field A) and precision agriculture (Field B) on two equal-sized fields planted with the same crop over one season. The results are summarised below:

Field A
Water usage: 10,000 litres
Fertiliser application: 500kg
Crop yield: 4,000kg
Environmental Impact: High

Field B
Water usage: 6,000 litres
Fertiliser applications: 300 kg
Crop yield: 4,500 kg
Environmental Impact: Low

Which conclusion is most accurate?

a. Precision agriculture reduces water and fertiliser usage but does not affect crop yield.
b. Traditional farming methods yield more crops but have a higher environmental impact.
c. Precision agriculture increases yield, conserves resources, and reduces environmental impact.
d. Both methods have similar environmental impacts, but precision agriculture uses less water and fertiliser.

Answer Key

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