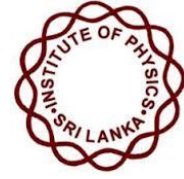




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SRI LANKAN JUNIOR SCIENCE OLYMPIAD-2024
ஸ்ரீ லங்கன் ஜூனியர் சயின்ஸ் ஓல்யம்பிஅட் -2024



Time: Two Hours

EXAM INSTRUCTIONS

1. Write your index number in the space provided on the answer sheet.
2. Select the correct answer for each question from the alternatives A, B, C, and D and indicate it on the answer sheet with a cross (as shown below). There is only one correct answer for each question.

Example: If (A) is the correct answer for question 01;

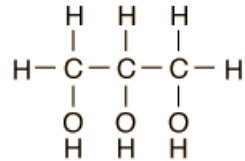
1	A	B	C	D
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3. If you want to change your answer, circle your first answer and then indicate the new answer using a cross (as shown below). You can only make ONE correction per question. *Example: If (A) is your first answer and (D) is your final answer;*

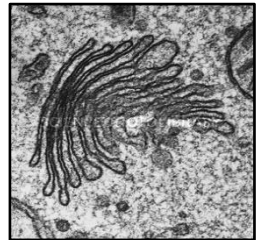
1	A	B	C	D
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4. The total number of questions is 50.

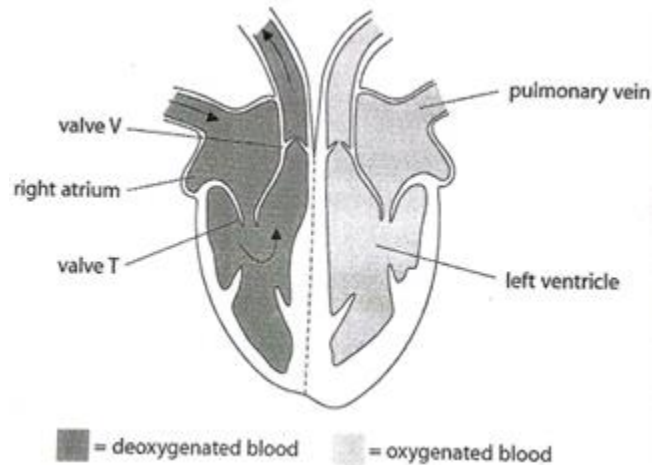
- Which of the following responses shows several hierarchical levels of biological organization in correct order?
 - Molecules, Organelles, Cells, Organs, Tissues, Organ systems, Organism
 - Molecules, Cells, Organelles, Organs, Tissues, Organ systems, Organism
 - Molecules, Organelles, Cells, Tissues, Organs, Organ systems, Organism
 - Molecules, Organelles, Cells, Tissues, Organ systems, Organs, Organism
- Which of the following properties of water is most helpful for minimizing temperature variation within organisms?
 - Water remains as a liquid within a wide range of temperatures.
 - Water molecules are held together by adhesive and cohesive forces.
 - Water has a high specific heat capacity.
 - Water has high latent heat of evaporation.
- Which one of the following compounds on hydrolysis will result in the chemical compound represent by the formula given below?



- (A) Cellulose (B) Fat (C) Starch (D) Glycerol
- In a DNA molecule consisting of 10000 nitrogenous bases of which 20% are adenine, the number of cytosine bases present is
 - 2000
 - 3000
 - 4000
 - 6000
 - Which of the following is correct regarding prokaryotic organisms?
 - All prokaryotic organisms are heterotrophic.
 - All prokaryotic organisms do not have peptidoglycan in their cell walls.
 - All prokaryotic organisms can fix atmospheric nitrogen.
 - All prokaryotic organisms are not microorganisms.
 - Function of the organelle given below is
 - Storing Ca^{2+} ions.
 - Manufacturing cellulose and non cellulose cell wall components.
 - Digest worn out organelles.
 - Transport residue materials out of the cell by exocytosis.
 - As a result of meiosis,
 - Two daughter cells with the same number of chromosomes are produced.
 - Four daughter cells with the same number of chromosomes are produced.
 - Two daughter cells with half the number of chromosomes of the parent cell are produced.
 - Genetically identical four daughter cells are produced.



8. Which one of the following **biological processes** does **not** require energy in the form of ATP?
- Conversion of glucose to pyruvic acid in glycolysis.
 - Conversion of starch to sugar during seed germination.
 - Conversion of carbon dioxide to sugar in photosynthesis.
 - Conversion of amino acids to proteins during protein synthesis.
9. During the process of photosynthesis, which of the following conversion takes place?
- Light energy is converted to electrical energy.
 - Electrical energy is converted to chemical energy.
 - Chemical energy is converted to light energy.
 - Light energy is converted to chemical energy.
10. Following is a diagram of the human heart.



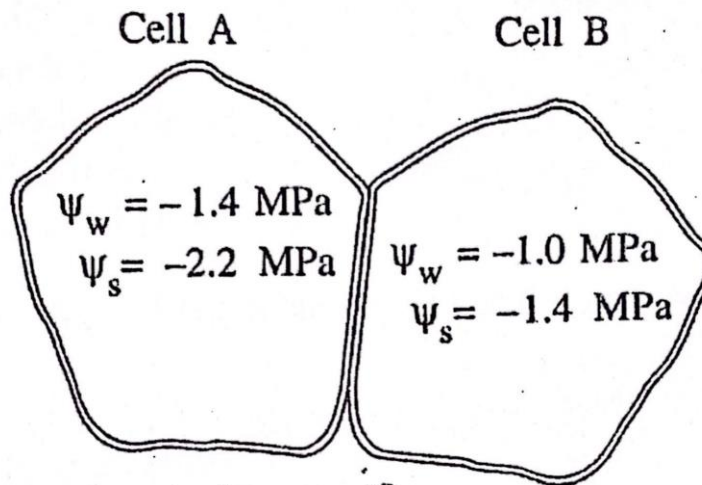
What happens when the right ventricle contracts?

- Valve V closes
 - Blood is forced into the left atrium
 - Valve T Closes.
 - Blood is forced into the pulmonary vein.
11. When a piece of leaf epidermis was immersed in distilled water for thirty minutes the cells became fully turgid and attained equilibrium. Which one of the following statements is correct with regard to these cells in equilibrium?
- Water potential and solute potential of the cell sap have equal and opposite values.
 - Water potential and pressure potential of cell sap equal values.
 - Solute potential and pressure potential of cell sap have equal and opposite values.
 - Water potential of cell sap is less than water potential of distilled water
12. Consider the following statements regarding the transport of organic food material in the phloem tissue.
- The food material transported is mainly glucose.
 - Transport of food material through the sieve tubes of phloem requires metabolic energy.
 - Transport of food material can occur in both directions within the phloem.
 - Transport of food material is stopped when phloem tissue is treated with respiratory inhibitors.

Correct statements are,

- (A) I and II (B) II and III (C) I and III (D) III and IV

13. A and B are two plant cells adjacent to each other. The water potential (ψ) and solute potential (ψ_s) values of the two cells are indicated in the diagram.

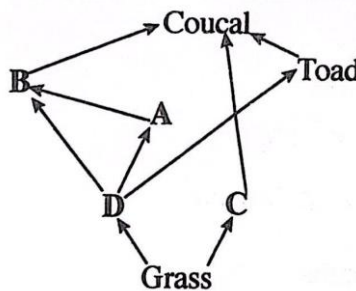


- I. Water will move from cell B to cell A.
- II. Movement of water will occur until water potential (ψ) of the two cells are equal
- III. Pressure potential (ψ_p) of cell is 1.0 MPa
- IV. Pressure potential (ψ_p) of cell B is 0.6 MPa

Which one of the above statements is **incorrect**?

- (A) I and II (B) II and III (C) III and IV (D) I and IV

14. Consider the following food web seen in a home garden ecosystem.



Which of the following statements regarding the above ecosystem is correct?

- (A) There are two primary consumers and three secondary consumers in this ecosystem.
- (B) The longest food chain in this ecosystem has four trophic levels.
- (C) Removing C will reduce the population of birds.
- (D) B may be a lizard and C may be a snail.

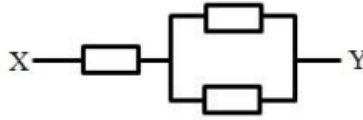
15. In an ecosystem, gross primary productivity, and the amount of energy available at the third trophic level were determined to be $2000 \text{ kJm}^{-2} \text{ year}^{-1}$ and $11 \text{ kJm}^{-2} \text{ year}^{-1}$ respectively. If 90% of energy is lost when flows from one trophic level to the next, the amount of energy used for respiration by the primary producers in this ecosystem is
(A) $900 \text{ kJm}^{-2} \text{ year}^{-1}$ (C) $1100 \text{ kJm}^{-2} \text{ year}^{-1}$
(B) $990 \text{ kJm}^{-2} \text{ year}^{-1}$ (D) $1800 \text{ kJm}^{-2} \text{ year}^{-1}$
16. Identify the monosaccharide from the following.
(A) Deoxyribose (B) Sucrose (C) Maltose (D) Lactose
17. The reaction $\text{NO}_2 + \text{CO} \rightarrow \text{NO} + \text{CO}_2$ takes place in two steps. Find the rate law.
 $2\text{NO}_2 \rightarrow \text{NO} + \text{NO}_3$ (k_1) – slow
 $\text{NO}_3 + \text{CO} \rightarrow \text{CO}_2 + \text{NO}_2$ (k_2) – fast
(A) $R = k_1 [\text{NO}_2]^3$ (B) $R = k_2 [\text{NO}_3] [\text{CO}]$ (C) $R = k_1 [\text{NO}_2]$ (D) $R = k_1 [\text{NO}_2]^2$
18. What happens to the size of atoms in p-block elements when we move from left to right in the same period?
(A) Size does not change (B) Size increases and then decreases
(C) Size increases (D) Size decreases
19. What is the EMF of a galvanic cell if $E^\circ_{\text{cathode}} = 0.80$ volts and $E^\circ_{\text{anode}} = -0.76$ volts?
(A) 1.56 volts (B) 0.04 volts (C) -1.56 volts (D) -0.04 volts
20. What is the concentration of the reactant in a first order reaction when the rate of the reaction is 0.6 Ms^{-1} and the rate constant is 0.035 s^{-1} ?
(A) 26.667 M (B) 17.143 M (C) 26.183 M (D) 17.667 M
21. Which of the following is a secondary amine?
(A) $\text{CH}_3\text{CH}_2\text{NHCH}_3$ (B) $(\text{CH}_3)_3\text{N}$ (C) $(\text{CH}_3\text{CH}_2\text{CH}_2)_2\text{NCH}_3$ (D) $\text{C}_6\text{H}_5\text{NH}_2$
22. Which of the following statements about starch is incorrect?
(A) It gives blue colour with iodine (B) It is a polymer of α -D-glucose
(C) It is a reducing carbohydrate (D) It consists of branched chains
23. Find the pH of a solution containing an equal volume of 0.10 M NaOH and 0.01 M HCl.
(A) 7.00 (B) 2.00 (C) 12.65 (D) 1.04

24. Which stage listed below is not a part of addition polymerization?
 (A) Initiation (B) Recrystallisation (C) Termination (D) Propagation
25. Which of the following ions is the strongest conjugate base?
 (A) Cl^- (B) SO_4^{2-} (C) CH_3COO^- (D) NO_3^-
26. A cathode and an anode are the most common components of an electrochemical cell. Which of the following claims about the cathode is correct?
 (A) Oxidation occurs at the cathode (B) Electrons move into the cathode
 (C) Usually denoted by a negative sign (D) Is usually made up of insulating material
27. What will be the concentration $[\text{OH}^-]$ in the solution, if it is prepared by 20.00 mL of 0.05 M HCl with 30.00 mL of 0.10 M $\text{Ba}(\text{OH})_2$?
 (A) 0.05 M (B) 0.40 M (C) 0.10 M (D) 0.12 M
28. A cell is prepared by dipping a copper rod in 1 M CuSO_4 solution and an iron rod in 2 M FeSO_4 solution. What are the cathode and anode respectively?
 (A) Cathode: Iron, Anode: Copper (B) Cathode: Copper, Anode: Iron
 (C) Cathode: Iron, Anode: Iron (D) Cathode: Copper, Anode: Copper
29. What is the oxidation state of nitrogen in di-nitrogen trioxide?
 (A) +1 (B) +2 (C) +3 (D) +4
30. What is the criterion of the feasibility of a reaction at any temperature? (ΔG is the change in Gibbs free energy)
 (A) ΔG of the reaction must be positive (B) ΔG of the reaction must be negative
 (C) ΔG of the reaction must be equal to zero (D) Does not depend on ΔG of the reaction

31. The masses and specific heat capacities of four materials are given in the table below. If 1000 J of heat is supplied to each material, which material will get the highest temperature change.

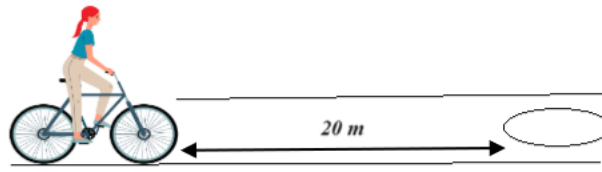
	Mass (kg)	Specific Heat capacity (J/kg K)
A	0.75	4200
B	1.00	2400
C	0.50	2500
D	1.25	2100

32. Three $100\ \Omega$ resistors are connected as shown in the figure below. The maximum power that can safely be delivered to any one resistor is $25.0\ \text{W}$.



What is the maximum current that can flow from X to Y.

- (A) $0.25\ \text{A}$ (B) $0.5\ \text{A}$ (C) $1.0\ \text{A}$ (D) $1.5\ \text{A}$
33. A cyclist sees a ditch on the road $20\ \text{m}$ away while paddling at $10\ \text{m/s}$. She applied the break and bicycle stopped just at the ditch. What is the time taken to stop the bicycle?



- (A) $2\ \text{s}$ (B) $4\ \text{s}$ (C) $5\ \text{s}$ (D) $10\ \text{s}$
34. An object is lifted against earth's gravity. Which equation shows the work done on the object?
- (A) work done = change in the position of by the object
 (B) work done = change in gravitational potential energy of the object
 (C) work done = change in gravitational force on the object
 (D) work done = change in velocity of the object

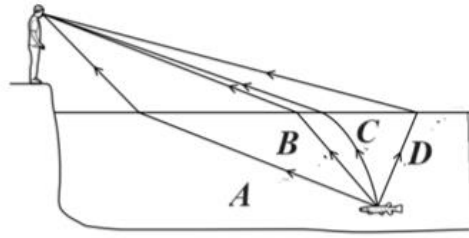
35. A $1.0\ \text{kg}$ steel block is at rest on a frictionless horizontal surface. A $0.5\ \text{kg}$ wooden block moves horizontally at $6.0\ \text{m/s}$ toward the steel block. Upon collision, the blocks stick together and move. What is the kinetic energy of the blocks after the collision?

- (A) $3\ \text{J}$ (B) $4\ \text{J}$ (C) $6\ \text{J}$ (D) $12\ \text{J}$

36. A bicycle tyre has a pressure of $P\ \text{Pa}$ at the temperature of $27^\circ\ \text{C}$ and contains n liters of air. How many air molecules are there in the tyre? R is the universal gas constant and N is the Avogadro's number.

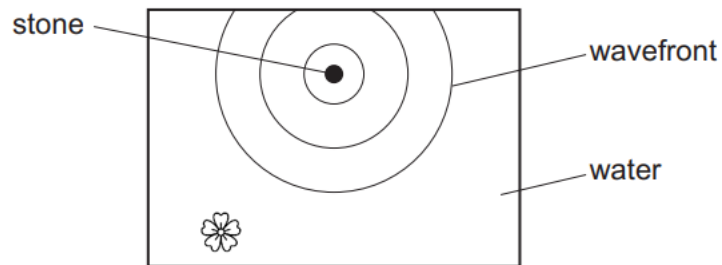
- (A) $\frac{PNn}{27R}$ (B) $\frac{PNn \times 10^{-3}}{27R}$ (C) $\frac{PNn \times 10^{-3}}{300R}$ (D) $\frac{PNn}{300R}$

37. A man sees a fish in a tank. Which path represents the correct path of light travelling from fish to man's eye?



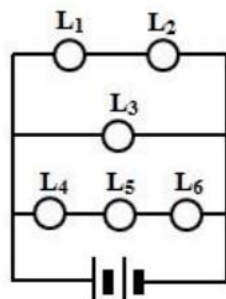
- (A) A (B) B (C) C (D) D

38. A flower floats on water in a pool. The flower is initially stationary. A stone is thrown into the pool, which causes a transverse water wave to move across the surface.



The diagram shows the view from above the pool. How does the flower behave as the wave passes it?

- (A) It moves away from where the stone hit the water.
 (B) It moves towards where the stone hit the water.
 (C) It stays the same distance from where the stone hit the water and vibrates inward and outward.
 (D) It stays the same distance from where the stone hit the water, and vibrates up and down
39. A battery and six identical light bulbs are connected as shown in the figure below.

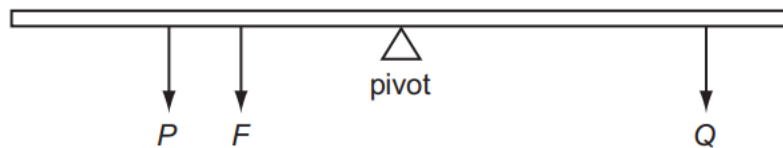


Consider the following statements.

- (I) L1 and L4 glow at the same brightness.
- (II) L3 bulb glows up with maximum brightness.
- (III) L6 glows brighter than L4.

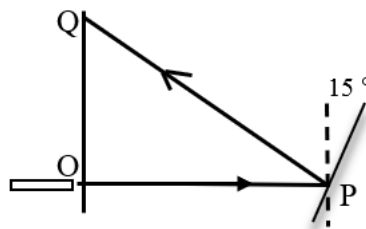
Which of these statements is true?

- (A) I only (B) II only (C) I and II only (D) I and III only
- 40 The diagram shows a plank balanced on a pivot.



Three forces F, P and Q act on the plank, as shown. If the force F increases, which change could make the plank balance again?

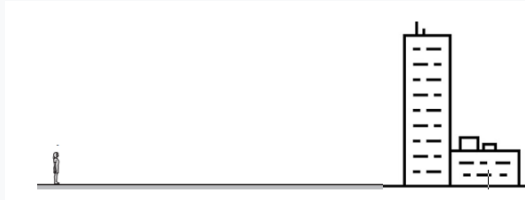
- (A) decrease Q (B) increase P
- (C) moving P away from the pivot (D) moving Q away from the pivot
41. A laser beam passes through a small hole in a screen to a point (P) on a mirror parallel to the screen. When the mirror is rotated through an angle of 15° about the point P, the laser beam falls on the point Q above the hole.



What is the angle \widehat{OPQ} .

- A) 10° (B) 15° (C) 20° (D) 30°

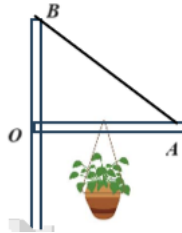
42. An application that can be downloaded to a mobile phone is an **acoustic stopwatch**. A student uses this application to measure the time t_1 between a sound of a horn and its echo from a tall building. He moves a distance d towards the building and again measures the time t_2 between the sound of the horn and its echo.



The speed (v) of sound in air is

- (A) $v = \frac{2d}{t_i - t_2}$ (B) $v = \frac{d}{t_i + t_2}$ (C) $v = \frac{d}{t_i - t_2}$ (D) $v = \frac{d}{2(t_i - t_2)}$

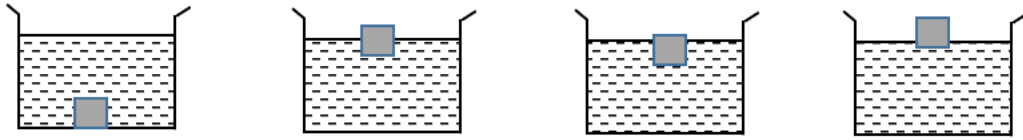
43. A flowerpot is hung as shown in the figure.



Which of the following statements is correct?

- (A) The moment about point O caused by the weight of the OA rod is equal and opposite in direction to the moment about point O caused by the weight of the flowerpot.
- (B) The moment about point O caused by the weight of the rod OA and the weight of the flowerpot is equal and opposite in direction to the moment about the point O caused by the tension in the string AB.
- (C) The moment about point O caused by the weight of the flowerpot is equal and opposite in direction to moment the moment about point O causes caused by tension in the string AB.
- (D) The weight of the rod OA and the weight of the flowerpot are equal to the tension in string AB.

44. The same block of wood remains in four containers of liquid as shown in the figure below. Which container has the densest liquid?



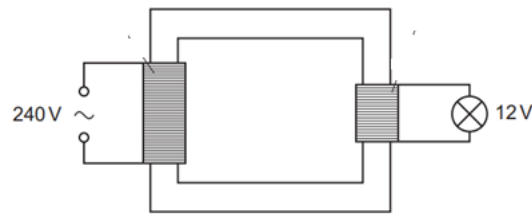
(A)

(B)

(C)

(D)

45. A step-down transformer is used to light a 12 V lamp from a 240 V mains supply. The lamp lights at normal brightness. The primary coil has 600 turns.



How many turns are in the secondary coil.

(A) 12

(B) 20

(C) 30

(D) 50

46. When heat is supplied to a certain solid at a constant rate, its temperature rises by 2 K per minute. When heat is supplied at the same rate, the same mass of substance will completely liquefy in 20 m and temperature remains constant. If the specific heat capacity of the solid is C and the latent heat of fusion is L , what is the C/L .

(A) $\frac{1}{40} \text{K}^{-1}$

(B) $\frac{1}{10} \text{K}^{-1}$

(C) 10K^{-1}

(D) 40K^{-1}

47. What is the equation of the line parallel to the line whose equation is $2y = 10x + 4$ and whose y -intercept is 6?

(A) $2y = 10x + 6$

(B) $y = -5x + 6$

(C) $y = 5x + 6$

(D) $2y = 10x - 6$

48. If $\frac{4^{2x+2}}{8} = 2^{3x-1}$, then x is

(A) 3

(B) -2

(C) 1

(D) 2

49. Sohani is sixteen years older than Janasha now. Five years later Janasha is half as old as Sohani. How old is Janasha now?

- (A) 6 (B) 11 (C) 13 (D) 15

50. If $\frac{Q}{t} = \frac{P\pi a^4}{8l\eta} + V$, then a is

- (A) $a = \left(\frac{Q-V}{t}\right) \left(\frac{P\pi}{8l\eta}\right)^{\frac{1}{4}}$ (C) $a = \sqrt{\left(\frac{Q-V}{t}\right) \frac{8l\eta}{p\pi}}$
(B) $a = \left(\left(\frac{Q-Vt}{t}\right) \frac{8l\eta}{p\pi}\right)^{\frac{1}{4}}$ (D) $a = \left(\frac{Q-Vt}{t}\right)^{\frac{1}{4}} \frac{8l\eta}{p\pi}$
