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SRI LANKAN JUNIOR SCIENCE OLYMPIAD-2022
ஸ்ரீ லங்கன் ஜூனியர் சயின்ஸ் ஓல்யம்பிஅட் -2022

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;

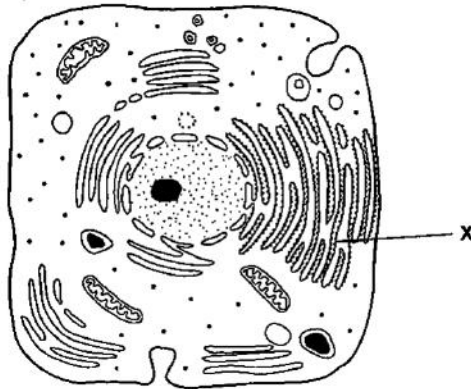
1	A	B	C	D
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3. If you want to change your answer, circle your first answer and then indicate the new answer using a cross (as shown below). You can only make ONE correction per question. *Example: If (A) is your first answer and (D) is your final answer;*

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

1. Which feature/s enable an organism to be identified as a prokaryote?
 1. cell wall 2. circular DNA 3. nucleus 4. ribosomes
- (A) 2 only (B) 3 only (C) 1 and 4 only (D) 2 and 4 only
2. The following diagram shows an electronmicrograph of a typical animal cell.

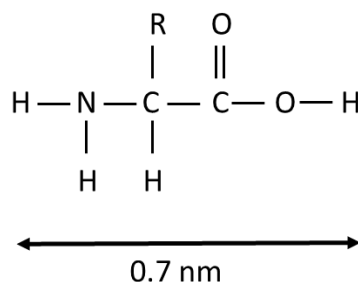


What is the function of the membrane system labelled X?

- (A) lipid synthesis
 (B) lipid synthesis and transport
 (C) protein synthesis
 (D) protein synthesis and transport
3. An animal cell and a plant cell are placed in distilled water. The animal cell swells and bursts, while the plant cell swells but does not burst. What accounts for this difference?
- (A) Animal cells have no vacuole.
 (B) Animal cells have no cell wall.
 (C) Plant cell surface membranes are partially permeable.
 (D) Plant cell walls are freely permeable.
4. The diameter of some atoms when they form bonds are given in the following table.

atom	single bond / nm	Double bond / nm
H	0.060	-
O	0.132	0.110
N	0.140	0.120
C	0.154	0.134

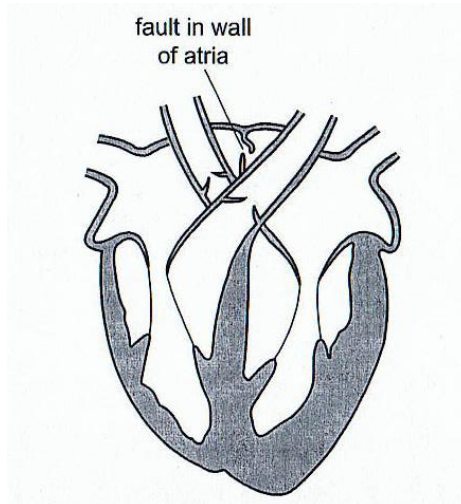
The approximate length of the amino acid shown below was estimated using the figures in the table.



What would be the approximate length of a dipeptide formed using this amino acid?

- (A) 0.9 nm (B) 1.1 nm (C) 1.4 nm (D) 1.7 nm

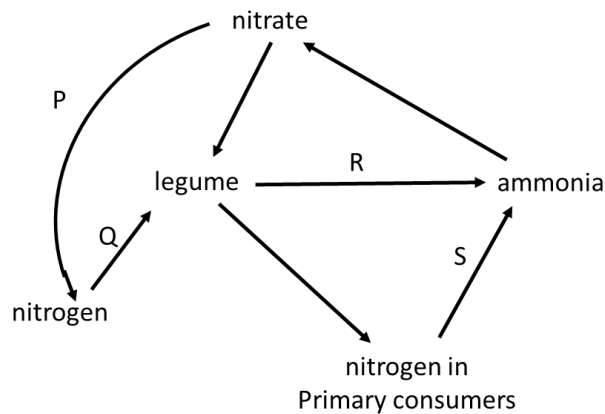
5. The diagram shows a fault in the wall between the atria of human heart.



- What effect would this defect have on the blood circulatory system?
- (A) increased pressure in the pulmonary artery
(B) irregular heart beat
(C) reduced oxygen saturation of hemoglobin in blood
(D) ventricular systole is delayed
6. Which statements about energy flow in ecosystems are correct?
1. All energy eventually leaves ecosystems in the form of heat.
 2. The average energy transfer between trophic levels is 10%.
 3. The energy stored and lost from an ecosystem is equal to the energy input from the Sun.
- (A) 1, 2 and 3 (B) 1 and 2 only (C) 1 and 3 only (D) 2 and 3 only
7. What is the **maximum** number of hydrogen bonds in a length of DNA containing 700 nucleotides?
- (A) 350 (B) 700 (C) 1050 (D) 2100
8. Many single-celled animals, living in fresh water, possess vacuoles which contract regularly, expelling excess water.
Why do the cells of plants living in fresh water not require such vacuoles?
- (A) Plant cells have a higher concentration of dissolved solutes than animal cells.
(B) Plant cell walls are impermeable to water.
(C) Plant cell walls limit cell size.
(D) Plant cells have a lower concentration of dissolved solutes than animal cells.
9. Which feature of water is **least** likely affect the life of an animal in a tropical rain forest?
- (A) adhesion with other molecules (B) cohesion between water molecules
(C) low viscosity (D) maximum density at 4 °C

10. What determines the rate of water movement from the roots to the leaves of a tall tree?
 (A) absorption of water through the root hair cells
 (B) root pressure
 (C) diffusion of water through the stomata
 (D) evaporation of water from the mesophyll cell walls.

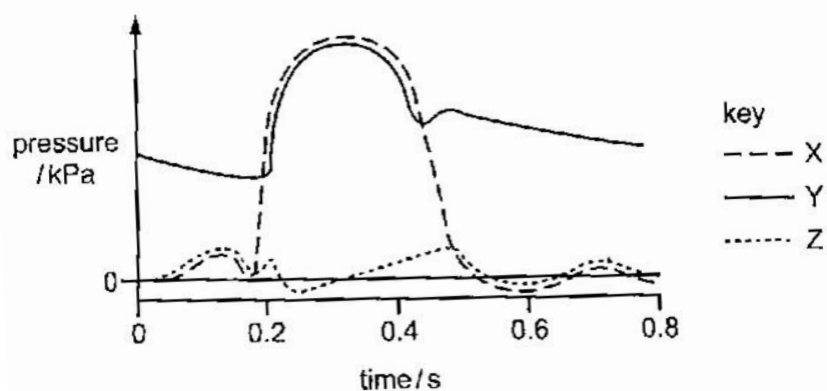
11. The diagram below shows a simplified nitrogen cycle.



Which row shows the correct labels for P, Q, R and S?

	P	Q	R	S
(A)	denitrification	nitrogen fixation by lightening	decomposition	decomposition
(B)	decomposition	nitrogen fixation by lightening	denitrification	decomposition
(C)	nitrification	denitrification	lightening	nitrogen fixation
(D)	denitrification	nitrogen fixation by rood nodule bacteria	decomposition	decomposition

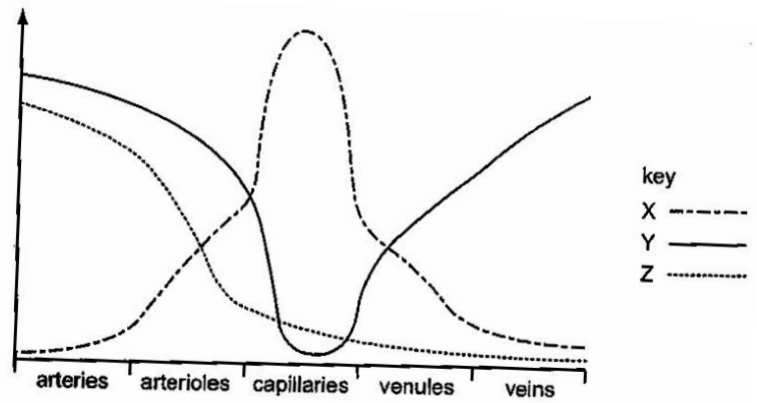
12. The diagram shows the pressure changes in various structures of the right side of the human heart during the cardiac cycle.



Which structures are represented by the letters X, Y and Z?

	X	Y	Z
(A)	pulmonary artery	right atrium	right ventricle
(B)	right atrium	pulmonary artery	right ventricle
(C)	right ventricle	pulmonary artery	right atrium
(D)	right ventricle	right atrium	pulmonary artery

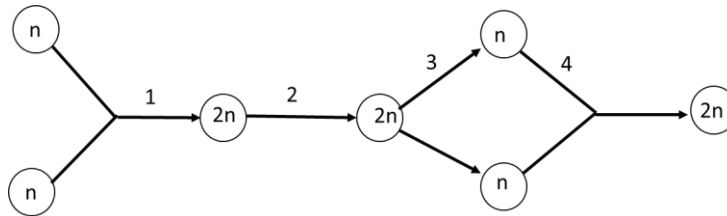
13. The graph represents data on blood vessels and blood flow.



Which row correctly identifies the curves?

	velocity of blood flow	pressure of blood	Total cross sectional area
(A)	X	Y	Z
(B)	X	Z	Y
(C)	Y	Z	X
(D)	Z	X	Y

14. The diagram represents the life cycle of a sexually reproducing animal.



Which row correctly identifies meiosis and mitosis?

	meiosis	mitosis
(A)	1	4
(B)	2	1
(C)	3	2
(D)	4	3

15. A polypeptide molecule contains the amino acid sequence:

glycine – leucine – lysine – valine.

The table shows DNA codes for the above amino acids.

glycine	leucine	lysine	valine
CCC	GAA	TTT	CAA

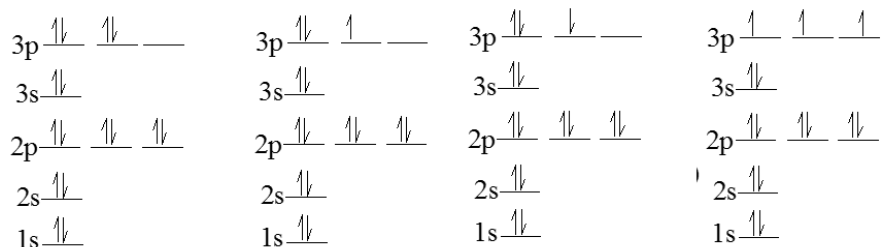
Which tRNA anticodones are needed for the synthesis of the above polypeptide?

- (A) CCC GAA TTT CAA (B) CCC GAA UUU CAA
 (C) GGG CUU AAA GUU (D) GGG CUU UUU GUU

16. Number of protons and number of neutrons of 4 atoms P, Q, R and S are given below. The isotope of atom P and the atom, which has the same mass number as atom P are,

	Protons	Neutrons
P	18	19
Q	16	19
R	18	18
S	17	20

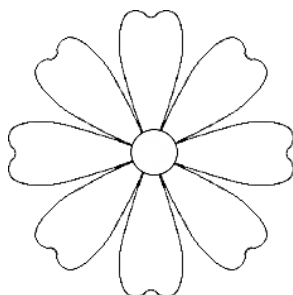
- (A) R and S (B) Q and R (C) Q and S (D) Only R
17. What is the correct electron arrangement of phosphorus atom?



- (A) (B) (C) (D)
18. Part of the periodic table is given below. What statement is correct about the elements given in the periodic table?

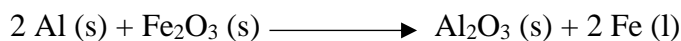
Li	Be
Na	Mg
K	Ca

- (A) Na is more reactive than K.
 (B) Atomic radius Mg is larger than that of K.
 (C) Li has more metallic character than Be.
 (D) Li is a softer metal than Na.
19. Assume that a mole is defined as the number of petals in the flower given below. If the mass of one mole of H₂O molecules is 18.0 g, what is the mass of one molecule of H₂O?



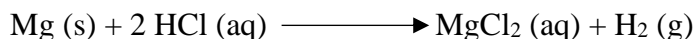
- (A) 18.01 g (B) 2.25 g (C) 8.00 g (D) 144.00 g

20. Consider the following equation;



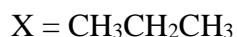
What is the mass of Al needed to make 28 g of Fe according to the given equation?
(Atomic masses: Al = 27, Fe = 56, O = 16).

- (A) 13.50 g (B) 58.07 g (C) 27.00 g (D) 16.59 g
21. Mass percentage of Carbon (C) of a compound is 80.00%. What could be this compound? (Atomic masses: C = 12.00, H = 1.00, N = 14.00, O = 16.00).
- (A) CO₂ (B) C₂H₆ (C) C₆H₆ (D) CH₄
22. Freezing point and boiling point of water in Fahrenheit (°F) are 32 °F and 212 °F respectively. Freezing point and boiling point of water in Celsius (°C) are 0 °C and 100°C respectively. Temperature of water was increased by 15 °C. What is this increment by °F?
- (A) 8.3 °F (B) 59.0 °F (C) 27.0 °F (D) 54.0 °F
23. Some compounds absorb water and form hydrates. In hydrates, water molecules are loosely bound to the compound. This hydrated water can be removed by heating the compound. Hydrate of calcium sulfate is written as CaSO₄•2H₂O, indicating that two water molecules are present in the hydrate. 50.0 g of CaSO₄•2H₂O was heated at 105 °C until it gives a constant mass. What is the expected constant mass? (Atomic masses: Ca = 40, S = 32, O = 16, H = 1).
- (A) 13.60 g (B) 2.72 g (C) 23.80 g (D) 39.53 g
24. Concentrated hydrochloric acid (Conc. HCl) is a 11 M (11 mol L⁻¹) solution. What is the volume of Conc. HCl needed to make 750 mL of 6 M HCl?
- (A) 49.500 mL (B) 0.409 L (C) 1.275 L (D) 40.900 mL
25. 250 mL of 0.10 M H₂SO₄ solution was mixed with 200 mL of 0.05 M H₂SO₄ solution. What is the H⁺ concentration of the final solution?
- (A) 0.070 mol L⁻¹ (B) 0.156 mol L⁻¹
(C) 0.030 mol L⁻¹ (D) 0.035 mol L⁻¹
26. The volume of H₂ gas produced by the following reaction collected at 1 atm pressure and temperature 0 °C is 12.5 L. How much Mg was needed for this reaction according to the following equation?



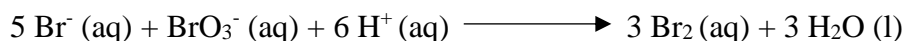
- (A) 13.392 g (B) 0.999 g (C) 24.000 g (D) 12.000 g

27. Among the three compounds given below, one compound is a solid, one compound is a gas and one compound is a liquid. What is the correct statement given below about these compounds?



- (A) X is a gas, Y is a liquid and Z is a solid.
(B) X is a gas, Y is a solid and Z is a liquid.
(C) X is a liquid, Y is a gas and Z is a solid.
(D) X is a liquid, Y is a solid and Z is a gas.

28. Consider the following reaction;



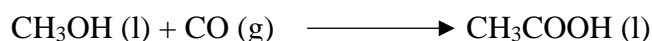
In an experiment, rate of removal of BrO_3^- was found to be 0.10 mol s^{-1} . What is the rate of formation of Br_2 in the reaction?

- (A) 0.10 mol s^{-1} (B) 0.003 mol s^{-1}
(C) 0.30 mol s^{-1} (D) 0.75 mol s^{-1}

29. Most of the recent explosions done by terrorists were by using an explosive called "mother of satan". This explosive is made by reacting the major compound present in nail polish removing liquid and the major compound present in a disinfectant. What are those two compounds?

- (A) hexane and glycerine (B) acetone and glycerine
(C) acetone and hydrogen peroxide (D) Glycerine and hydrogen peroxide

30. A New method of making acetic acid (CH_3COOH) in industries use the reaction given in the following equation.



When 2 moles of CH_3OH is reacted with 1 mole of CO , 40.0 g of CH_3COOH was formed. What is the percentage yield of the reaction?

- (A) 100.0 % (B) 33.3 % (C) 66.6 % (D) 0.15%

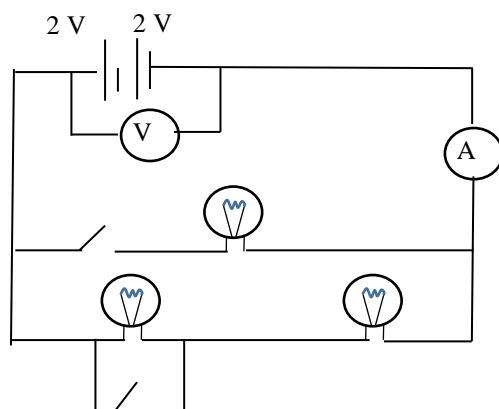
31. The densities of metals X and Y are 7.0 g cm^{-3} and 3.0 g cm^{-3} respectively. The metals of equal mass are melted and mixed to form an alloy. What is the density of this alloy?

- (A) 1.8 g cm^{-3} (B) 2.1 g cm^{-3} (C) 4.2 g cm^{-3} (D) 5.3 g cm^{-3}

32. A step-down transformer changes 240 a.c to 12 a.c. There are 600 turns in the primary coil. How many turns are there in the secondary coil?

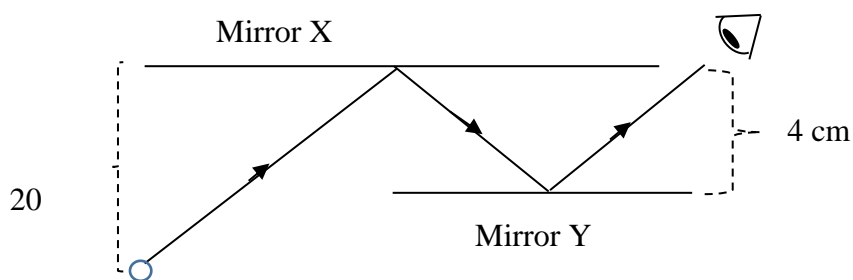
- (A) 20 (B) 30 (C) 40 (D) 120

33. The diagram shows three identical lamps connected to two 2V cells.

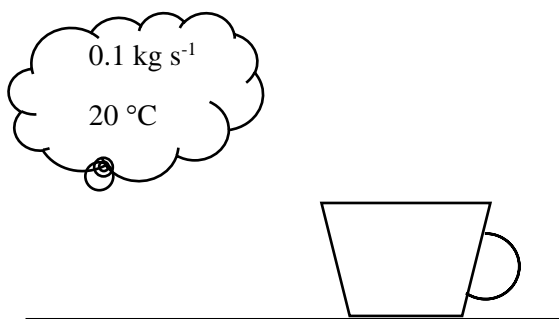


When the switches are open the ammeter reads 10 mA. What would be the readings of the voltmeter and ammeter when the switches are closed?

- (A) 4 V, 20 mA (B) 2 V, 20 mA (C) 4 V, 40 mA (D) 4 V, 60 mA
34. The figure below shows how a ray of light from an object O enters the eye, after being reflected twice. What is the distance to the final virtual image of O from the mirror X?



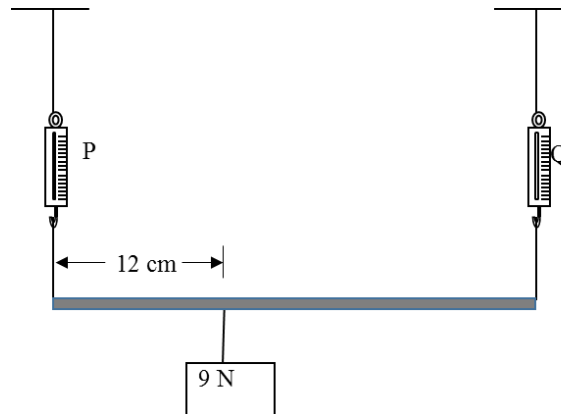
- (A) 20 cm (B) 24 cm (C) 28 cm (D) 30 cm
35. A cup of hot coffee of mass 200 g is at an initial temperature of 90 °C. A wind at temperature of 20 °C is blowing across the cup of coffee at a rate of 0.1 kg s⁻¹. After moving over the cup, the temperature of the wind increased to 25 °C.



If the specific heat of coffee is 4 kJ kg⁻¹ °C⁻¹ and that of air is 1 kJ kg⁻¹ °C⁻¹, what is the time needed to cool the cup of to 40 °C?

- (A) 20 s (B) 40 s (C) 50 s (D) 80 s

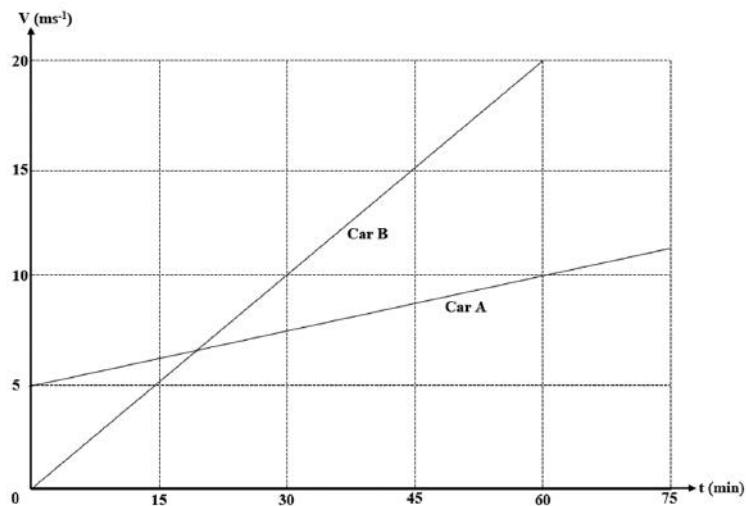
36. A load of 9.0 N has been placed on a light rod which is suspended from two scales, P and Q as shown in the diagram. The length of the rod is 36 cm.



Which of the following gives the correct readings of scales P and Q?

	Reading on P	Reading on Q
(A)	3.0 N	6.0 N
(B)	4.5 N	4.5 N
(C)	6.0 N	3.0 N
(D)	9.0 N	9.0 N

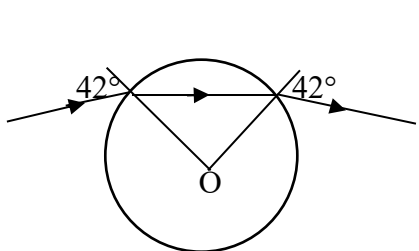
37. The speed time graphs of car A and car B are shown below. When will the two cars meet?



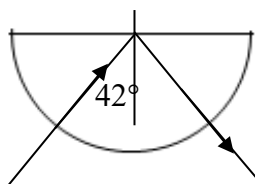
- (A) 18 min (B) 36 min (C) 40 min (D) 45 min
38. The atmospheric pressure (P) is equal to the pressure at the bottom of 10 m deep water. An air bubble rises to the surface of a lake from its bottom which is 20 m deep. The volume of the air bubble is 6 cm^3 at the bottom of the lake. What would be the volume of air bubble at the surface of the lake?

- (A) 9 cm^3 (B) 12 cm^3 (C) 15 cm^3 (D) 18 cm^3

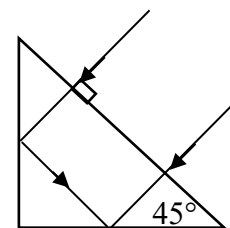
39. A ray of light is incident on three glass blocks as shown in the figure. The critical angle of glass is 41° .



(1)



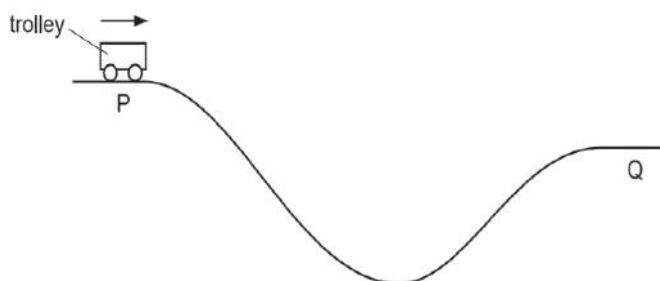
(2)



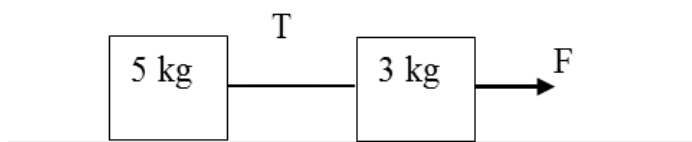
(3)

In which of the diagram(s) is /are the path of the light ray is correct?

- (A) (1) only
 (B) (2) and (3) only
 (C) (1) and (3) only
 (D) All Correct
40. A trolley runs from P to Q along a track. At Q, its potential energy is 50 kJ less than at P. At P, the kinetic energy of the trolley is 5 kJ. Between P and Q, the work trolley does against friction is 10 kJ. What is the kinetic energy of the trolley at Q?



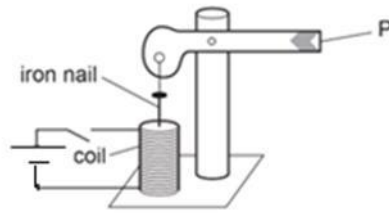
- (A) 35 kJ
 (B) 45 kJ
 (C) 55 kJ
 (D) 65 kJ
41. Two wooden blocks connected by a string are moving with the acceleration of 2 m s^{-2} .



Which gives the force F and tension T in the string respectively?

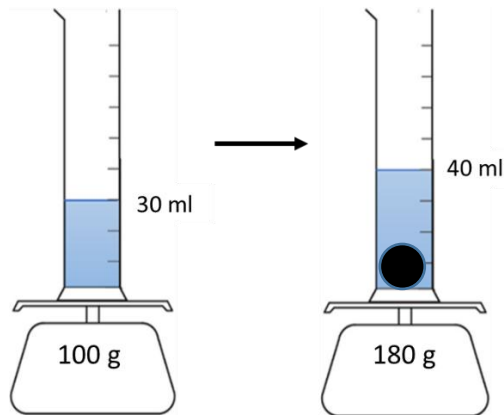
- (A) $F = 10 \text{ N}$, $T = 16 \text{ N}$
 (B) $F = 16 \text{ N}$, $T = 10 \text{ N}$
 (C) $F = 10 \text{ N}$, $T = 10 \text{ N}$
 (D) $F = 16 \text{ N}$, $T = 16 \text{ N}$
42. A crane lifts a load of 6000 N through a vertical distance of 15 m in 30 s. what is the average power during this operation?
- (A) 200 W
 (B) 400 W
 (C) 3000 W
 (D) 6000 W

43. A set up has been arranged using a battery, a coil, a metal nail and a pivoted light rod.



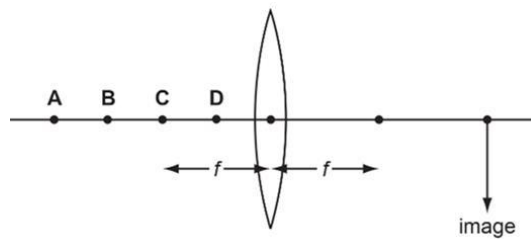
What happens to the edge of P when the switch is closed?

- (A) It goes down and stays down.
 (B) It goes up and stays up.
 (C) It goes down and then returns to its original position
 (D) It goes up and then returns to its original position.
44. A measuring cylinder containing some water stands on a scale pan. A solid ball is lowered into water and the water level rises from the 30 cm^3 mark to the 40 cm^3 mark. The scale reading increases from 100 g to 180 g .



What is the density of the material of the ball?

- (A) 2 g cm^{-3} (B) 4.5 g cm^{-3} (C) 8.0 g cm^{-3} (D) 18 g cm^{-3}
45. The diagram shows a thin converging lens of focal length f . Where must an object be placed to produce a real image in the four positions, A, B, C and D shown?



- (A) A (B) B (C) C (D) D
46. If $2^{2x-2} = 2^{x-1} \times 8$, then x is

- (A) -2 (B) -1 (C) 2 (D) 4

47. If $R = \frac{(S+T)^2}{3}P$, then S is

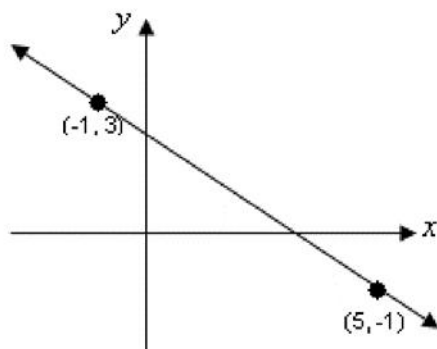
(A) $s = \left(\frac{3R}{P}\right)^2 - T$

(B) $s = \left(\frac{3P}{R}\right)^2 - T$

(C) $s = \sqrt{\frac{3R}{P}} - T$

(D) $s = \sqrt{\frac{3P}{R}} - T$

48. Which gives the gradient and intercept of the shown line respectively?



(A) $-\frac{3}{4}, \frac{7}{3}$

(B) $-\frac{3}{2}, \frac{5}{3}$

(C) $-\frac{1}{3}, \frac{3}{5}$

(D) $-\frac{2}{3}, \frac{7}{3}$

49. If $\frac{4x+3}{2} - \frac{2x-1}{3} = 3$, what is x ?

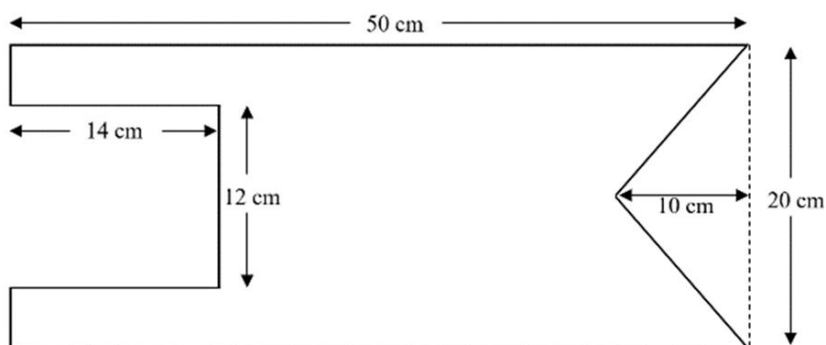
(A) $\frac{7}{3}$

(B) $\frac{3}{7}$

(C) $\frac{8}{7}$

(D) $\frac{7}{8}$

50. What is the area of shape shown below?



(A) 582 cm^2

(B) 707 cm^2

(C) 732 cm^2

(D) 750 cm^2

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