



National Level Science Talent Search Examination

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CLASS 11 (PCB)

Please fill the following details immediately

Name _____

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Questions : 60

Time : 60 minutes

INSTRUCTIONS

Read all instructions carefully before attempting any question.

- Ensure that the 'Class' printed here and inside, is the same as the test you are appearing for.
- You must complete the paper within the time allotted.
- Do not open this question paper until you are permitted to.
- You are not allowed to use a calculator.
- Figures herein are not to scale. Hence, you cannot depend on the estimate of size or measurement. Use your knowledge of the subject.
- Rough work shall be carried out only in the space provided for the same throughout this booklet. No separate sheets are allowed for the same.
- Return your answer sheet to the invigilator soon after completion and before leaving the examination hall. Take the question paper with you.
- There is no negative marking.
- Results would be made available on www.unifiedcouncil.com

PAPER CODE UN487



UCN/QP-11(PCB)/01



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- 01** Which visible feature(s) of the plant cell in the diagram distinguish(es) it from an animal cell ?



1. Absence of numerous small vacuoles
2. Cytoplasm pushed to periphery of the cell
3. Presence of chloroplasts
4. Presence of cell wall

- (A) 4 only (B) 3 and 4 only
(C) 1, 3 and 4 only (D) 2, 3 and 4 only

- 02** Which of the following correctly matches a process in human nutrition to the portion of the digestive system in which it occurs ?

	Process	Portion of the digestive system
(A)	Ingestion	Oesophagus
(B)	Digestion	Stomach
(C)	Absorption	Pancreas
(D)	Assimilation	Large intestine

05 Why is it crucial for root hair cells to have mitochondria ?

- (A) To release energy for active transport of mineral salts.
- (B) To release energy for active transport of sugars and amino acids
- (C) To release energy for metabolic processes since chloroplasts are absent
- (D) To release energy for osmosis of water into the cell

06 Which of the following elements are found in all proteins ?

- | | |
|--------------|--------------|
| (1) Oxygen | (2) Carbon |
| (3) Nitrogen | (4) Hydrogen |

- (A) 1 and 2 only
- (B) 2 and 3 only
- (C) 1, 2 and 4 only
- (D) 1, 2, 3 and 4

07 Which of the following food tests should be carried out to test the presence of carbohydrates ?

- | | |
|---------------------------|-----------------|
| (1) Benedict's test | (2) Biuret test |
| (3) Ethanol emulsion test | (4) Iodine test |

- (A) 1 only
- (B) 1 and 2 only
- (C) 1 and 4 only
- (D) 2 and 3 only

08 Can you identify the best explanation for the presence of stones in the stomach of birds ? (Note: Birds lack teeth)

- (A) They give the bird a greater feeling of fullness.
- (B) They help regulate the pH of the stomach.
- (C) They help to masticate the food.
- (D) They provide bulk to the food to aid in peristalsis

09 Why is photosynthesis an important process ?

1. It allows all organisms to utilise sunlight to synthesize sugars.
2. It is responsible for the store of chemical energy in coal.
3. It renews oxygen supplies in the atmosphere to sustain respiration.

- (A) 1 only (B) 1 and 2 only
(C) 1 and 3 only (D) 2 and 3 only

10 Which of the following correctly compares the primary mode of nutrition in animals and plants ?

- (A) Plants are able to synthesise light energy, unlike animals.
(B) Plants are able to convert light energy to chemical energy, unlike animals.
(C) Plants utilise mineral salts taken in from the environment, but are not used.
(D) Plants do not have to rely on digesting food substances, but animals do.

11 Which of the following are functions of white blood cells ?

1. Phagocytosis
2. Antibody formation
3. Antigen formation
4. Clotting of blood

- (A) 1 and 2 only (B) 1 and 3 only
(C) 1, 3 and 4 only (D) 1, 2, 3 and 4

12 Why is it crucial for red blood cells to be biconcave in shape ?

- (A) To speed up the rate of absorption of oxygen
- (B) To slow down the rate of uptake of carbon dioxide
- (C) To speed up the rate of uptake of nutrients
- (D) To maximise the amount of haemoglobin in the cell

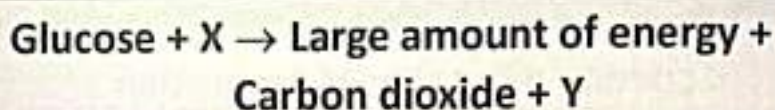
13 The three chambered heart is found in small amphibians such as the frog, while the four chambered heart is found in large mammals such as man. Why would it NOT be advantageous for humans to have a three chambered heart ?

- (A) Human hearts are too large to have only one ventricle.
- (B) The blood sent to the brain may be insufficiently oxygenated.
- (C) The exchange of gases in the lungs would be reduced because of the very low blood pressure.
- (D) The transport of glucose would be inefficient to all parts of the body

14 Why are there more stomata on one side of the leaf blade for most dicotyledonous plants ?

- (A) The lower surface contains more stomata, since it is less exposed to sunlight compared to the upper surface.
- (B) The upper surface contains more stomata, since it is more exposed to wind compared to the lower surface.
- (C) Gaseous exchange is more efficient if there are more openings concentrated on one side of the leaf blade.
- (D) The distribution of stomata is random, thus either side might end up with slightly more or less stomata.

- 15 The equation for aerobic respiration is:



Which of the following correctly identifies X and Y ?

	X	Y
(A)	Oxygen	Lactic acid
(B)	Oxygen	Water
(C)	Water	Oxygen
(D)	Water	Lactic acid

- 16 Which of the following would occur in the plant as a result of wilting ?

- Guard cells become flaccid and stomata close.
- The rate of photosynthesis decreases.
- The amount of water lost in transpiration decreases.

- (A) 2 only (B) 3 only
(C) 1 and 2 only (D) 1, 2 and 3

- 17 An athlete was made to run 2.4 km at sea level and at an area with a high altitude. It was found that he had trouble breathing at the higher altitude. Which of the following best explains why this happened ?

- (A) The atmospheric pressure at a high altitude is higher and so air rushes into the lungs much slower.
(B) There is a lower concentration of oxygen in the air at higher altitudes.
(C) The Concentration of CO_2 is higher at higher altitudes.
(D) The red blood cells produced contain less haemoglobin at higher altitudes.

18 Microscopic examination revealed that the pancreatic cells of a particular patient have very low numbers of Golgi bodies. What symptoms might this patient be facing ?

1. Poor digestion of fatty foods.
2. Swollen feet due to excessive water retention in the blood.
3. Lack of energy due to unstable blood glucose levels.
4. Excessive production of urine due to underactive kidneys.

- (A) 1 and 3 only
 (B) 1, 2 and 3 only
 (C) 1, 3 and 4 only
 (D) None of the above

19 Which of the following is/are part(s) of the central nervous system ?

1. Brain
2. Motor neurones
3. Spinal cord

- (A) 1 only
 (B) 1 and 2 only
 (C) 1 and 3 only
 (D) 1, 2 and 3

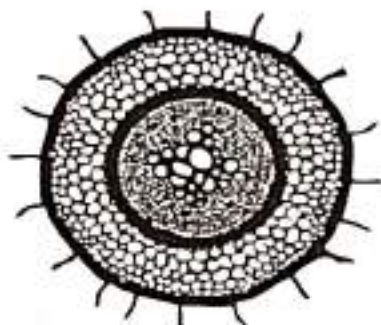
20 Which of the following are hormones produced by the pancreas ?

- (A) Insulin and glucagon
 (B) Insulin and glycogen
 (C) Amylase and trypsin
 (D) Glucagon and trypsin

- 21** Which of the following statements about a voluntary action is true ?
- (A) It always involves the contraction of muscles.
 - (B) It always involve the spinal cord.
 - (C) It is always initiated by a sense organ.
 - (D) It is always initiated in the brain.
- 22** Which of the following molecules is/are digested in the stomach ?
- (A) Amino acids
 - (B) Fats
 - (C) Proteins
 - (D) Starch
- 23** Why the secretion of adrenaline increase the conversion of glycogen to glucose in the liver and muscles ?
- (A) A high level of glucose will increase breathing rate.
 - (B) A high level of glucose will result in a reduced need.
 - (C) Glucose is required for respiration to release energy for muscular contraction.
 - (D) There will be a reduced need for the secretion of glucagon.

Space for rough work

- 24** Refer to the following diagram showing the cross-section of a dicotyledonous root.



Which of the following is NOT appropriate evidence that the above diagram shows the cross-section of a root ?

- (A) There is no central pith.
 - (B) Both xylem and phloem vessels are present.
 - (C) The arms of the xylem tissue alternate with regions of phloem tissue.
 - (D) The epidermal layer contains long cytoplasmic extensions.
- 25** Refer to the diagram of a structure from the human respiratory system.

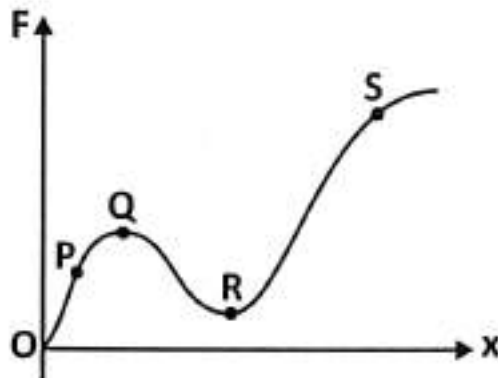


What is the identity of the structure shown in the diagram ?

- (A) Alveolus
- (B) Cilia
- (C) Haemoglobin
- (D) Sternum

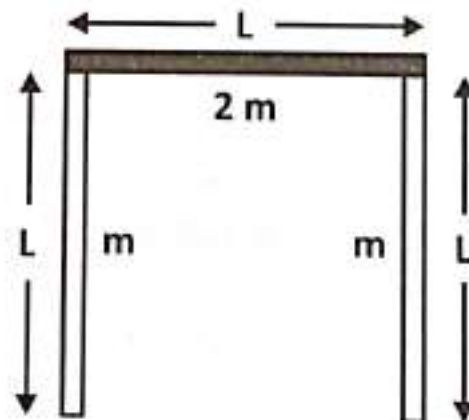
- 26 Identify a correct statement.
- (A) When the total area of the acceleration-time graph is negative, it always mean that the final velocity of the particle is negative.
 - (B) When the total area of the velocity-time graph is negative, it always mean that the final displacement of the particle is negative.
 - (C) When the total area of the velocity-time graph is negative, it may happen that the particle returns to its original position.
 - (D) When the total area of the acceleration-time graph is negative, it may happen that the final velocity of the particle is zero.
- 27 A person who weighs 800 N steps onto a scale that is on the floor of an elevator car. If the elevator accelerates upward at a rate of 5 m/s^2 , what will the scale read ?
- (A) 400 N
 - (B) 800 N
 - (C) 1000 N
 - (D) 1200 N
- 28 A bullet of mass 0.01 kg is fired horizontally into a 4 kg wooden block at rest on a horizontal surface. The coefficient of kinetic friction between the block and the surface is 0.25. The bullet remains embedded in the block and the combination moves 20 m before coming to rest. With what speed did the bullet strike the block ?
- (A) 157.16 m/s
 - (B) 173.28 m/s
 - (C) 185.65 m/s
 - (D) 198.24 m/s

- 29 The diagram given below represents the applied force per unit area (F) with the strain (x) produced in a thin wire of uniform cross-section in the curve shown.



The region in which the wire behaves like a viscous liquid is

- (A) PQ (B) QR (C) RS (D) OP
- 30 Three thin, uniform rods each of length L are arranged in the shape of an inverted U.



The two rods on the arms of the U each have mass m , the third rod has mass $2m$. How far below the midpoint of the horizontal rod is the center of mass of this assembly?

- (A) $\frac{L}{8}$ (B) $\frac{L}{4}$ (C) $\frac{3L}{8}$ (D) $\frac{L}{2}$

- 31** The unit of length convenient on the atomic scale is known as an angstrom and is denoted by \AA : $1 \text{\AA} = 10^{-10} \text{ m}$. The size of a hydrogen atom is about 0.5\AA . What is the total atomic volume in m^3 of a mole of hydrogen atoms ?
- (A) $2.95 \times 10^{-5} \text{ m}^3$ (B) $3.16 \times 10^{-7} \text{ m}^3$
(C) $5.74 \times 10^{-9} \text{ m}^3$ (D) $8.01 \times 10^{-11} \text{ m}^3$
- 32** Two identical balls X and Y are thrown simultaneously from the same point with the same speed at different angles. Ball X is thrown at 60° with the horizontal and it takes 4 s to reach a point at a horizontal distance of 40 m. If the ball Y is thrown at 30° , then
- (A) it travels a horizontal distance of 40 m.
(B) it takes 2 s to reach the ground.
(C) both the balls reach the ground at the same instant.
(D) both (A) and (B)
- 33** If g_0 is the acceleration due to gravity at poles, then its value at a latitude θ is (where ω is the angular speed of rotation and R is the radius of earth).
- (A) $g = g_0 - \omega^2 R \cos \theta$ (B) $g = g_0 - \omega^2 R \sin \theta$
(C) $g = g_0 - \omega^2 R \cos^2 \theta$ (D) $g = g_0 - \omega^2 R \sin^2 \theta$

Space for rough work

- 34** A hemispherical bowl just floats without sinking in a liquid of density $1.2 \times 10^3 \text{ kg m}^{-3}$. If outer diameter and the density of the bowl are 1 m and $6 \times 10^3 \text{ kg m}^{-3}$ respectively, then the inner diameter of the bowl will be
- (A) 0.93 m (B) 0.2 m
(C) 0.43 m (D) 0.6 m
- 35** A bomb of mass 1 kg is thrown vertically upwards with a speed of 100 m/s. After 5 seconds, it explodes into two fragments. One fragment of mass 400 gram is found to go down with a speed of 25 m/s. What will happen to the second fragment just after the explosion ? ($g = 10 \text{ m/s}^2$).
- (A) It will go upwards with speed 100 m/s
(B) It will go upwards with speed 40 m/s
(C) It will go upwards with speed 60 m/s
(D) It will go downwards with speed 40 m/s
- 36** An ideal gas is confined to a container whose volume is fixed. If the container holds n moles of gas, by what factor will the pressure increase if the absolute temperature is increased by a factor of 2 ?
- (A) $\frac{2}{(nR)}$ (B) 2 (C) $2nR$ (D) $\frac{2}{n}$
- 37** The sum of magnitudes of two forces acting at a point is 16 and magnitude of their resultant is $8\sqrt{3}$. If the resultant is at 90° with the force of smaller magnitude, then their magnitudes are :
- (A) 3, 13 (B) 2, 14
(C) 5, 11 (D) 4, 12

38 If T_A, T_B, T_C and T_D are the respective temperatures at A, B, C and D. Then, choose the correct statement if $T_A = T_0$.

(A) The maximum temperature during the cycle occurs at C

(B) $T_D = 3T_0$

(C) $T_B = 2T_0$

(D) All the above

39 Two astronauts have deserted their space ships in a region of space far from the gravitational attraction of any other body. Each has a mass of 100 kg and they are 100 m apart. They are initially at rest relative to one another. How long will it be before the gravitational attraction brings them 1 cm closer together ?

(A) 2.52 days

(B) 1.41 days

(C) 0.70 days

(D) 1.41 hr

40 Given below are some physical quantities.

1. Stefan's constant

2. Coefficient of volume expansion

3. Work done

4. Velocity gradient

Identify the correct order in which the dimensions of time decreases in the given physical quantities.

(A) 2, 4, 3, 1

(B) 1, 2, 3, 4

(C) 4, 3, 2, 1

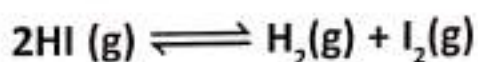
(D) 3, 2, 4, 1

Space for rough work

41 The bond dissociation energies of H—H, C—C and C—H bonds respectively are 104.2, 83.1 and 98.8 kcal mol⁻¹. The electronegativity of carbon is

- (A) 2.53 (B) 2.51
 (C) 2.50 (D) 2.52

42 The equilibrium constant, K for the reaction



at room temperature is 2.85 and that at 698 K, it is 1.4×10^{-2} .

This implies that :

- (A) HI is exothermic compound
 (B) HI is very stable at room temperature
 (C) HI is relatively less stable than H₂ and I₂
 (D) HI is resonance stabilised

Space for rough work

- 43 Match the species in column I with the geometry in column II.

	Column I (Species)		Column II (Geometry)
P.	H_3O^+	1.	Planar
Q.	$H_2C = NH$	2.	Angular
R.	ClO_2^-	3.	Tetrahedral
S.	NH_4^+	4.	Trigonal bipyramidal
T.	PCl_5	5.	Pyramidal

- (A) P-2, Q-1, R-3, S-5, T-4
 (B) P-1, Q-5, R-2, S-3, T-4
 (C) P-5, Q-1, R-2, S-3, T-4
 (D) P-3, Q-1, R-4, S-5, T-2
- 44 Vinylcarbinol formula is
- (A) $HO-CH_2-CH = CH_2$
 (B) $CH_3CH(OH) = CH_2$
 (C) $CH_3-CH = CH-OH$
 (D) $CH_3-C(CH_2OH) = CH_2$
- 45 Find the percentage purity of sodium chloride, 6.5 g of which when dissolved in water and treated with excess of silver nitrate solution gave 14.35 g of silver chloride.
- (A) 35 (B) 56
 (C) 82 (D) 90

- 46** Excess of KI reacts with CuSO_4 solution and then $\text{Na}_2\text{S}_2\text{O}_3$ solution is added to it. Which of the given statements is incorrect for this reaction ?
- (A) Cu_2I_2 is formed (B) Evolved I_2 is reduced
(C) $\text{Na}_2\text{S}_2\text{O}_3$ is oxidised (D) CuI_2 is formed
- 47** Calculate the energy in kJ/g atom emitted when electrons in 1.0 g atom of hydrogen undergo transition giving spectral line of the lowest energy in the visible region of its atomic spectrum.
[$R_H = 1.1 \times 10^7 \text{ m}^{-1}$; $c = 3 \times 10^8 \text{ m s}^{-1}$; $h = 6.62 \times 10^{-34} \text{ J s}$]
- (A) 155.8 (B) 163.2
(C) 182.6 (D) 194.7
- 48** The pK_a of acetyl salicylic acid (aspirin) is 3.5. The pH of gastric juice in human stomach is about 2—3 and pH in the small intestine is about 8. Aspirin will be
- (A) unionised in the small intestine and in the stomach.
(B) completely ionised in the small intestine and in the stomach.
(C) ionised in the stomach and almost unionised in the small intestine.
(D) ionised in the small intestine and almost unionised in the stomach.

Space for rough work

- 49** Two organic compounds P and Q, both containing only C and H yield, on analysis, the same percentage composition by weight :

$$C = (12/13) \times 100\% \text{ and } H = (1/13) \times 100\%$$

P decolourises Br_2 – water but Q does not.

Identify P and Q.

- (A) $P = C_2H_2$, $Q = C_6H_6$ (B) $P = C_6H_6$, $Q = C_2H_2$
(C) $P = C_2H_4$, $Q = C_2H_6$ (D) $P = C_2H_2$, $Q = C_3H_8$
- 50** The enthalpy of combustion of ethanol and the enthalpies of formation of water and carbon dioxide at 298 K are -1367 and -285.9 , -393.4 kJ/mol respectively. Calculate the heat of formation of ethanol at 298 K in $kJ\ mol^{-1}$.

- (A) 136.6 (B) -277.5
(C) 245.8 (D) -377.6

- 51** A compound contains 69.5% oxygen and 30.5% nitrogen and its molecular weight is 92. The formula of the compound is

- (A) N_2O (B) NO_2
(C) N_2O_4 (D) N_2O_5

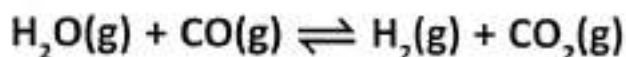
- 52** The values of electronegativity of atoms A and B are 1.20 and 4.0 respectively. The percentage of ionic character of A–B bond is

- (A) 50% (B) 72.24%
(C) 55.3% (D) 43%

53 Which of the following is correct ?

- (A) ${}^1_1\text{H}$ and ${}^3_2\text{He}$ are isotopes
- (B) ${}^{14}_6\text{C}$ and ${}^{14}_7\text{N}$ are isotones
- (C) ${}^{39}_{19}\text{K}$ and ${}^{40}_{20}\text{Ca}$ are isotones
- (D) ${}^{19}_9\text{F}$ and ${}^{24}_{11}\text{Na}$ are isobars

54 1 mole of H_2O and 1 mole of CO are taken in a 10 litre vessel and heated to 725 K. At equilibrium 40 percent of water (by mass) reacts with carbon monoxide according to the equation:



Calculate the equilibrium constant for the given reaction.


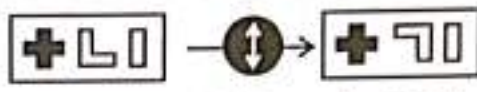


- (A) 0.16
- (B) 0.38
- (C) 0.44
- (D) 0.56

Space for rough work


- 55 Following statements represent the periodic trends of chemical reactivity of the alkali metals and the halogens. Which of these statements is correct about them ?
- (A) Chemical reactivity increases with increase in atomic number down the group in both the alkali metals and halogens
 - (B) In alkali metals the reactivity increases but in the halogens it decreases with increase in atomic number down the group
 - (C) The reactivity decreases in the alkali metals but increases in the halogens with increase in atomic number
 - (D) In both the alkali metals and the halogens, the chemical reactivity decreases with increase in atomic number down the group





Space for rough work

56 Given question contains a process with an input diagram. One or more 'operators', and an output diagram. The effect of the operators is described in the key to question. Study the process and decide which is the correct output from the options ?

 <p>Rotates all symbols 90° clockwise</p>	 <p>Rotates middle symbol 180°</p>
 <p>Each symbol moves one place to the right</p>	 <p>Reflects all symbols in X axis</p>

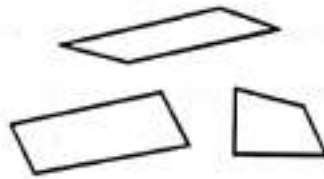
Which option replaces the question mark ?


?

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

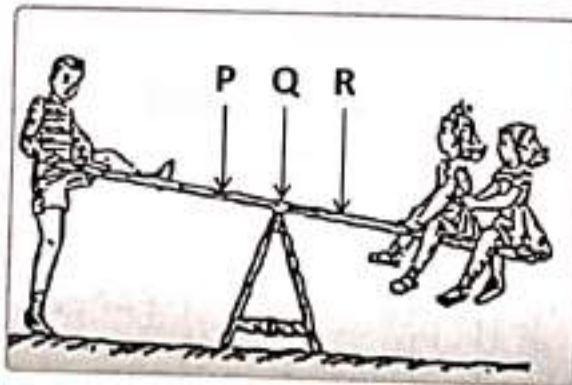
Space for rough work

57 Which figure could be assembled using each of the provided pieces ?



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

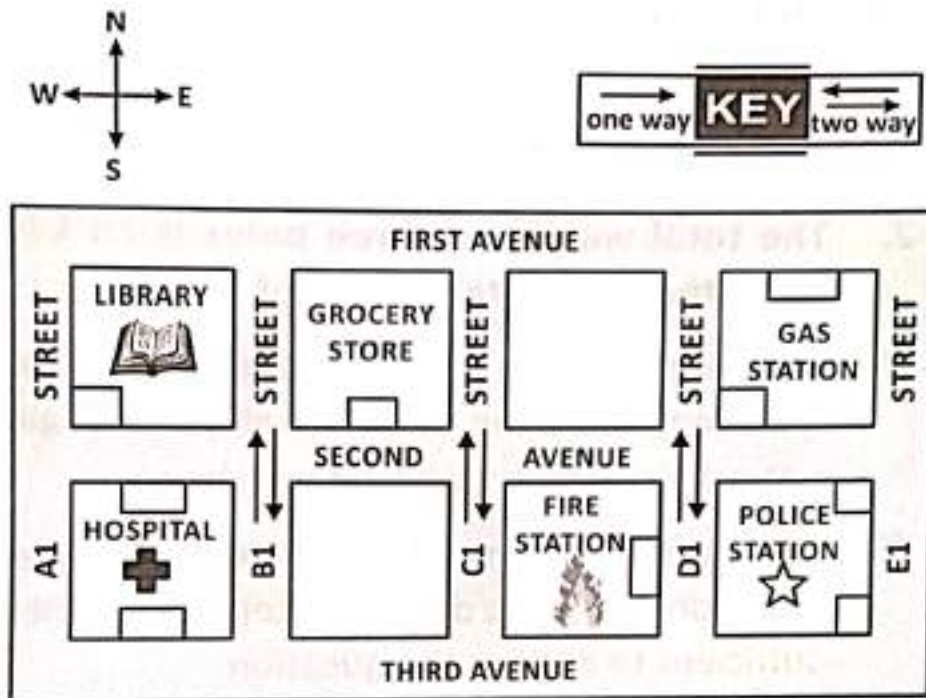
58 At which point is the sea-saw most likely to break ?



- (A) P (B) Q
 (C) R (D) Can't be determine

Space for rough work

59 Study the map and answer the question.



The delivery boy from the grocery store calls to ask directions to the firehouse so that he can delivery the order. You should direct him to walk.

- (A) West on Second Avenue to D1 Street, make a left, and go half a block to the firehouse.
- (B) East on Second Avenue to D1 Street, make a right, and go half a block to the firehouse.
- (C) West on Second Avenue to D1 Street, make a right, and go half a block to the firehouse.
- (D) East on First Avenue to D1 Street, make a left, and go half a block to the firehouse.

Space for rough work

- 60 What will be the total weight of 10 poles, each of the same weight ?

Statements:

1. One fourth of the weight of each pole is 5 kg.
 2. The total weight of three poles is 20 kilograms more than the total weight of two poles.
- (A) Statement I alone are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question
- (B) Statement II alone are sufficient to answer the question, while the data in statement I alone are not sufficient to answer the question
- (C) Statement I alone or in statement II alone are sufficient to answer the question
- (D) Both statements I and II together are not sufficient to answer the question

Space for rough work