**Questions (INJSO 2010)**

**Section A:** Questions 1 to 60 are multiple choice with every correct answer carrying 1 mark and every wrong answer carrying -0.25 mark.

## SECTION A

**Q1.** Which of the following organelle is the site for ribosome synthesis?

a) Ribosomes
b) Cytoplasm
c) Nucleus
d) Nucleolus

**Q2.** In the chemical reaction

$$3\ Br_2 + 6CO_3^{-2} + 3\ H_2O \rightarrow BrO_3^- + 5Br^- + 6HCO_3^-$$

a) bromine is reduced and water is oxidized
b) bromine is oxidized and carbonate is reduced
c) bromine is both oxidized and reduced
d) bromine is neither oxidized nor reduced



**Q3.** A flat mirror creates a virtual image of your face. Which of the following optical elements in combination with the flat mirror can form a real image?

a) Convex lens
b) Concave lens
c) Concave mirror
d) Convex mirror

**Q4.** Change in enthalpy ($\Delta H$) for combustion of fuel is:

a) Positive
b) Zero
c) Negative
d) May be negative or positive

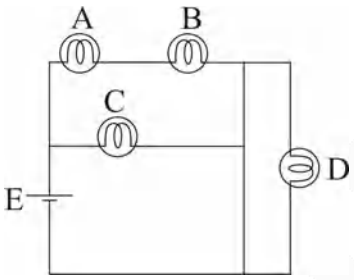
**Q5.** Phospholipid 'Cardiolipin' is unique to cell membranes of -

a) Chloroplasts
b) Mitochondria
c) Golgi complex
d) Nucleus

**Q6.** During aerobic respiration, energy is released in stepwise manner and ATP formation takes place with the help of this energy. What will happen if this energy is released at a single step instead of in parts?

a) Incomplete oxidation of glucose takes place
b) all the amount of energy can be utilized by the cell as more ATP molecules are produced
c) maximum amount of this released energy is wasted in form of heat and cell may die
d) cell will follow anaerobic pathway of respiration

**Q7.** Consider the circuit below:



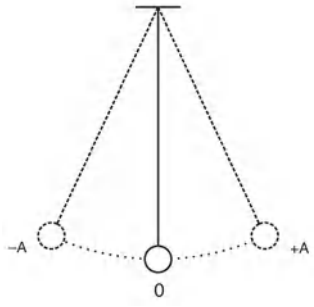

a) If the bulb A burns out, then bulb C stays lighted, bulb B burns brightly
b) If the bulb B burns out, then bulb C goes off and D stays lighted
c) If the bulb C burns out, bulbs A and B go off
d) If the bulb D burns out, the event is unnoticeable, and bulbs A, B, C stays lighted.

**Q8.** All molecules in the following set are allotropes of carbon:

a) Charcoal, lead, coke
b) Galena, glassy carbon, graphite
c) Bucky balls, graphite, diamond
d) Charcoal, wood, soot

**Q9.** A pendulum moves back and forth under the influence of gravity from x = -A to +A with time period T, as shown in figure. At time t = 0, it is at x = +A; when T = 0.75T, then:

a) it is at x = 0 and travelling towards x = +A
b) it is at x = 0 and travelling towards x= -A
c) it is at x = +A and is at rest
d) it is between x = 0 and +A and is travelling towards x = -A



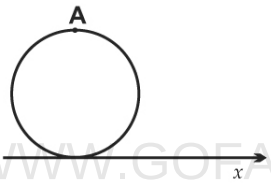
**Q10.** A solution of $H_2SO_4$ is 80% by weight, having specific gravity 1.73. Its normality is:

a) 18.0
b) 28.2
c) 1.0
d) 10.0

**Q11.** Which of the following complementary structures will be produced during replication of DNA sequence 5'-TpApGpAp-3' ?

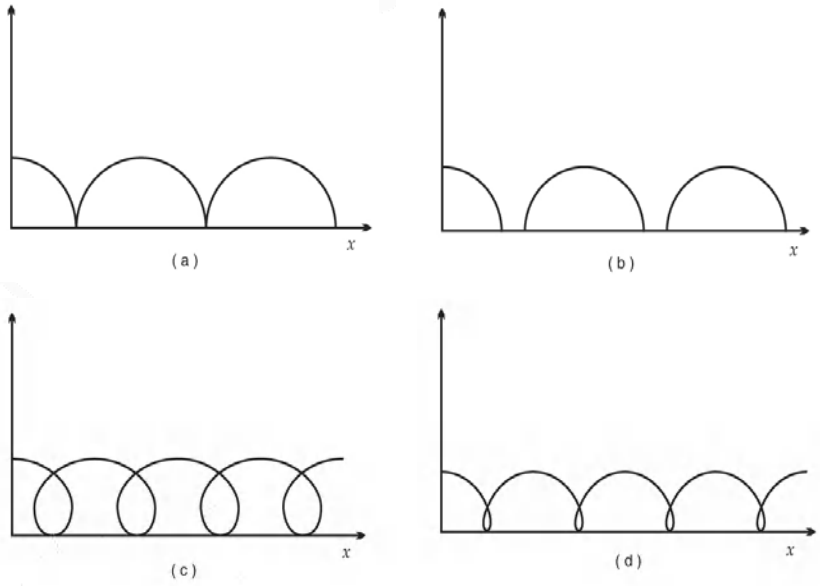
a) 5'-GpCpGpAp-3'
b) 5'-ApTpCpTp-3'
c) 5'-UpCpUpAp-3'
d) 5'-TpCpTpAp-3'

**Q12.** Let there be a rigid wheel rolling without sliding on a horizontal surface.

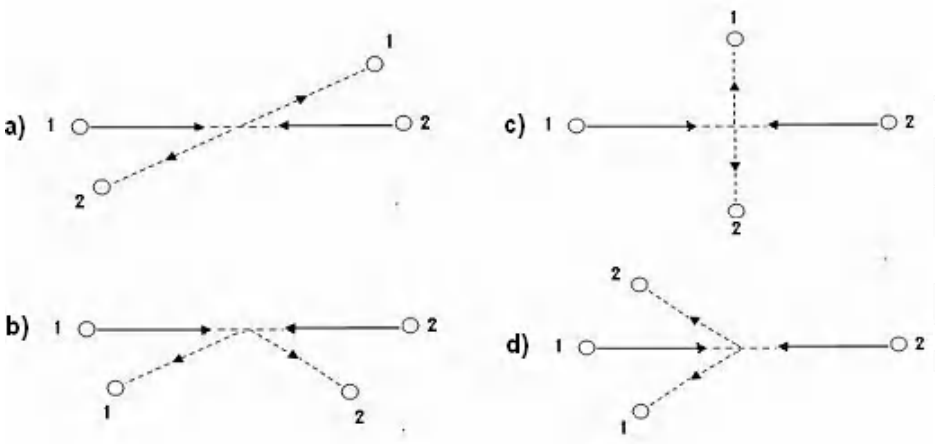





The path of point 'A' as seen by an observer on the ground, when the wheel is moving along x axis is:



**Q13.** Two identical balls (1 and 2) collide on a frictionless surface. Collision may or may not be elastic. Which of the views physically impossible situation?




**Q14.** Given 1 $dm^3$ of 0.15 M HCl and 1 $dm^3$ of 0.40 M HCl. What is the maximum volume of 0.25 M HCl which can be made by directly mixing the two solutions without adding water?

a) 1 $dm^3$
b) 2 $dm^3$
c) 0.667 $dm^3$
d) 1.667 $dm^3$



**Q15.** The inflammatory response is triggered whenever body tissues are injured. E.g. it occurs in response to physical trauma (a blow), intense heat and irritating chemicals as well as infection by viruses, fungi and bacteria.
Arrange the major events involved in the inflammatory process in the correct order as they occur in the body.

i. Mast cells secrete histamine and cytokines.
ii. Phagocytosis by monocytes.
iii. Cytokines attract neutrophils and monocytes to injured site.
iv. Tissue injury
v. Diapedesis or emigration of neutrophils & monocytes into the area through the capillary.
vi. Vasodilation of arterioles & increased capillary permeability causes redness and swelling.

a) iv)→ i)→iii)→ vi)→ v)→ ii)
b) iv)→ i) → v)→ vi)→ iii)→ ii)
c) iv)→ vi)→ iii)→ ii)→ i)→ v)
d) iv)→ i)→ vi)→ iii)→ v)→ ii)

**Q16.** Baban arrives in your office for genetic counseling. Baban's brother Tapan dies at a young age from a hereditary Tay-Sach's disease. Both he and his sister Suman are unaffected. What is the chance of Suman being a carrier of this disease?

a) 1/4
b) 2/3
c) 1/3
d) 1/9

**Q17.** In the question above, if Baban's son Amar and Suman's daughter Asha are married to each other, and are expecting their first child. What is the chance that the child would have Tay-Sach's disease?

a) 1/4
b) 1/9
c) 1/72
d) 1/36

**Q18.** Four masses are located as shown in the figure. Acceleration due to gravity is same everywhere. What is the position of centre of gravity for the system?




a) 2m
b) 2.5m
c) 3m
d) 2.7m

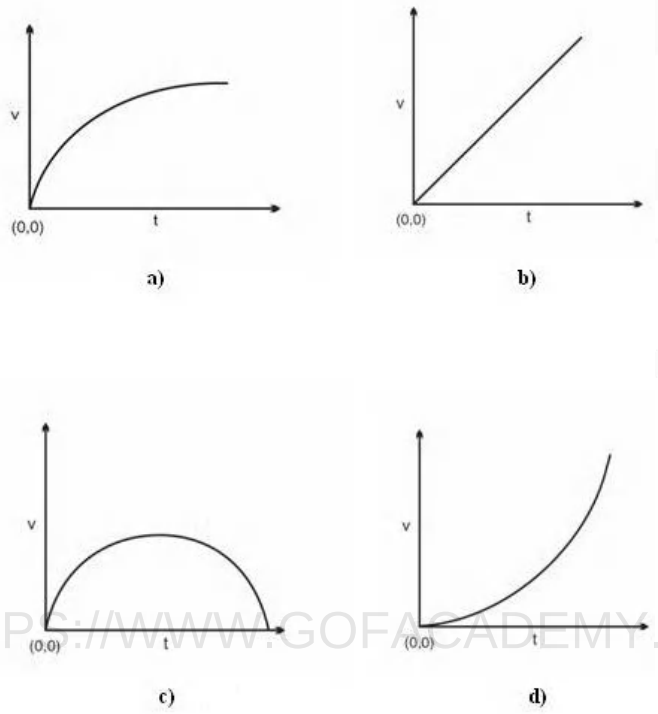
**Q19.** Calculate the mass of Lithium that contains same number of atoms as present in 8g of Magnesium. Atomic masses of lithium and magnesium are 7 and 24 respectively.

a) 8g
b) 3g
c) 7g
d) 2.3g

**Q20.** Which of the following are insoluble in water but will dissolve in aqueous NaOH?

a) $Mg(OH)_2$
b) $Fe(OH)_3$
c) $Cu(OH)_2$
d) $Zn(OH)_2$

**Q21.** A large water tank is filled at a constant rate of 10litres/min. It has an outlet of maximum flow of 10 litres/min at the bottom of the tank, but the output is proportional to the water present in the tank at any given time. How will the 'v', volume of water content in the tank, change with time?






**Q22.** Human blood pressure (B.P.) is represented by what is called a "pressure picture". In a normal human being, the pressure picture is 120/80/40 where 120 represents systolic pressure, 80 represents diastolic pressure, and 40 represents the pulse pressure which is the resultant difference in the two pressures. In one of the patients, the pressure picture was found to be 140/110/30 suggesting that there has been –

a) an increase in the resistance from arteries
b) a decrease in the resistance from arteries
c) an increase in the resistance from veins
d) a decrease in the resistance from veins

**Q23.** Which of the following will be helpful in studying the details of surface texture of hair?

a) Binocular microscope
b) Scanning Electron Microscope
c) Transmission Electron Microscope
d) Phase- Contrast Microscope

**Q24.** Increase in pressure shifts the equilibrium of the reaction

$$N_2(g) + 3H_2(g) \leftrightarrow 2NH_3(g)$$

a) to produce more $N_2$
b) to produce more $NH_3$
c) to reduce the temperature of the reaction
d) to produce more $H_2$

**Q25.**A solution containing $Na_2CO_3$ + NaOH requires 300 ml of 0.1N HCl using phenolphthalein indicator. Methyl orange is then added to the above titrated solution and a further 25 ml of 0.2 N HCl is required. What is the amount of NaOH present in the solution?

a) 0.8 g
b) 1.0 g
c) 1.5 g
d) 2.0 g

**Q26.** When a ray of white light enters a prism, it begins to spread out in rainbow colours (Fig.1).



Fig.1

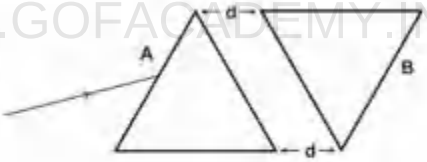



Fig.2

An inverted prism is brought close to this prism as shown in the Fig.2,
Both the prisms are made of same material. If a ray of white light is incident on surface A and "d" is made zero then output from surface "B" will be:

a) white light.
b) rainbow colours which are converging.
c) rainbow colours which are spreading out.
d) no light comes out from surface B.

**Q27.** Which of the following oxides is an acid anhydride?

a) $Al_2O_3$
b) $CO_2$
c) CO
d) Red lead

**Q28.** In dispersive materials,

a) the angle of refraction for a light ray depends on the wavelength of light
b) the angle of refraction for a light ray does not depend on the wavelength of light
c) the angle of reflection from the surface of the material does not depend on the wavelength of light
d) Both (a) and (c) hold true.

**Q29.** There are two tracks A and B as shown in the figure. The direction of gravity is also shown in the figure.


If two similar balls begin to move at same uniform velocity at the same time which of the two balls will reach the end of the track faster?



a) Ball on track A
b) Ball on track B
c) They will reach on the same time
d) Cannot decide by the data given.

**Q30.** A human DNA molecule that was 6800A° long was cut into 5 equal sized pieces using molecular scissors. How many nucleotides were present in each of the cut pieces?

a) 800 nucleotides
b) 400 nucleotides
c) 80 nucleotides
d) 1360 nucleotides

**Q31.** The relationship between respiration and photosynthesis is truly intricate. What will be the effect on the number of mitochondria and chloroplasts in a plant species occurring in higher altitude as compared to the same plant species in lower altitudes?

a) number of mitochondria and number of chloroplasts will remain unchanged
b) number of mitochondria in high altitude variety will be more
c) number of chloroplasts in high altitude variety will be more
d) both number of mitochondria and number of chloroplasts will be less in high altitude variety

**Q32.** A radioactive nuclide has a half life of 8 hours. Half life is the time in which 50 % of the nuclei disintegrate. The fraction of the nuclide which will disintegrate in 32 hours will be:

a) 0.062
b) 0.75
c) 0.875
d) 0.938

**Q33.** If length is increased by 20% and width is decreased by 20% then, which of the following is correct:

| | **Perimeter** | **Area** |
|---|---|---|
| a) | Cannot say | Increases by 4% |
| b) | Increases by 4% | Cannot say |
| c) | Increases by 4% | Decreases by 4% |
| d) | Cannot say | Decreases by 4% |

**Q34.** The alimentary canal of insect consists of mouth, pharynx, oesophagus, crop, proventriculus, gizzard and hindgut. In insects and birds, the gizzard helps in grinding the food. Select the statements that most accurately compare the gizzards of the bird and of insect.



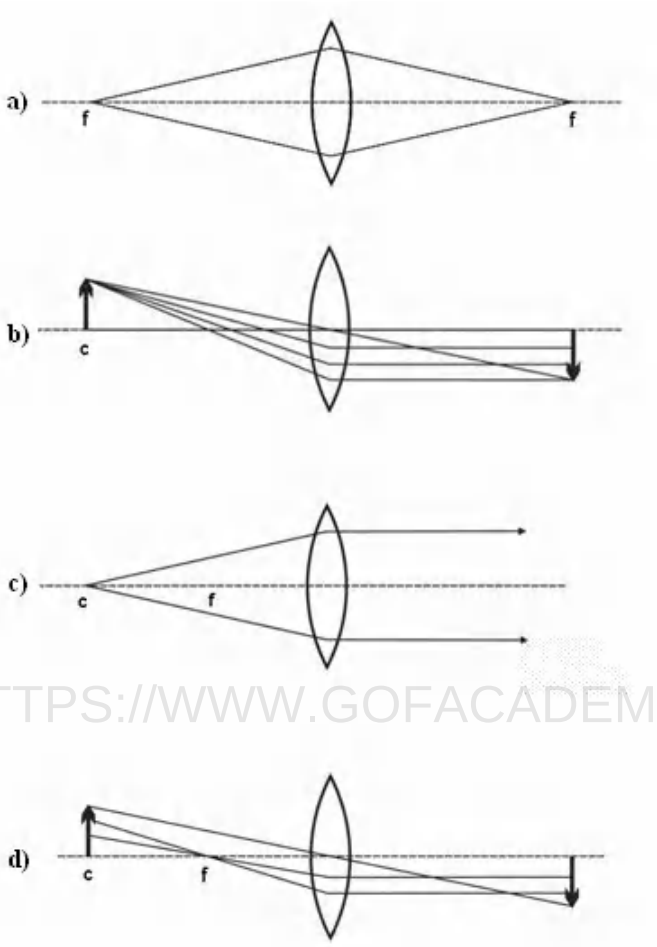
i. The gizzard of the bird contains gravel and the gizzard of insect bears chitinous teeth.
ii. The gizzard of the bird is muscular but that of the insect is devoid of muscles.
iii. The gizzard in both cases is muscular.
iv. The gizzard of bird bears bristles which are absent in the gizzard of insect.

a) i and iii
b) i and ii
c) ii and iv
d) iii and iv

**Q35.** In a room there are four objects – a wooden dish, steel dish, glass dish and a copper dish. If a fire is lit in the room so that it burns at 300 degrees centigrade, and is equidistant from all the four dishes, then after a long time the dishes can be listed in the increasing order of temperature. Which is the correct order of temperature of dishes?

a) wooden dish > steel dish > glass dish > copper dish
b) steel dish > copper dish > glass dish > wooden dish
c) copper dish > steel dish > glass dish > wooden dish
d) none of the above

**Q36.** Which of the following is correct? (Figures not to be scaled). The focal point of the lens is f and point c is equal to 2f.






**Q37.** Occasionally a baby is born with a defect in septum of the heart. A tiny rupture, or a hole in the septum is a usual defect in such cases. If this kind of a defect exists in the inter- ventricular septum of a baby, what will be physiological consequences of this defect?

a) Body receives deoxygenated blood, hence she may lose her life unless operated upon immediately.
b) So long as baby is calm and quiet she remains normal, however on exertion or crying her skin turns bluish and baby gets exhausted.
c) Heart cannot pump blood effectively, so blood does not reach all the tissues.
d) Since valves are normal, systemic as well as pulmonary circulations are normal but blood pressure is low.

**Q38.** 50 $cm^3$ of 1.5 M NaOH is titrated against 2M HCl. The pH of the reaction system after the addition of 35ml of HCl will be:

a) 0.084 b) 1.23 c) 12.77 d) 7.95

**Q39.** The elements most likely to conduct electricity are the ones where electrons are not tightly bound to the nucleus. The trend for electrical conductivity in the following is:

a) Li> Na> S> Ne
b) S> Li> Na> Ne
c) Ne> Na> Li> S
d) Na> Li> S> Ne

**Q40.** According to Darwin's theory of evolution, which of the following is a necessary condition (pre-requisite) for natural selection?

a) variation among individuals of a population in some heritable characteristic
b) variation in habitat within the population of species
c) variation in environmental conditions that suit the individual
d) all of the above

**Q41.** If earth were to stop spinning then your weight on equator will be



a) heavier by around 0.5%
b) heavier by around 5%
c) less by around 0.5 %
d) less by around 5%

**Q42.** A dwarf pea plant is treated with a hormone gibberellic acid. It was found that the plant height increases rapidly. Thus it was conformed that gibberellic acid brings about increase in the height of the plant. If this treated plant is crossed with normal dwarf pea plant, what kind of progeny would you expect?

a) All tall
b) All dwarf
c) 50% tall and 50% dwarf
d) 75% tall and 25% dwarf

**Q43.** The volume occupied by 1.6g of oxygen under NTP conditions is:

**a)** 1.12 $dm^3$ b) 5.60 $dm^3$ c) 11.20$dm^3$ d) 22.4$dm^3$

**Q44.** A perfectly spherical elastic balloon of 0.2 meter diameter was filled with hydrogen gas at sea level. What will be its volume at an altitude where pressure is 0.65 atm. What will be the diameter of the balloon?

a) 0.20 m b) 0.23 m c) 0.10 m d) 0.32 m

**Q45.** A colourless crystalline solid 'B' dissolved easily in water. On addition of dilute HCl to the aqueous solution of 'B', no change was observed. When NaOH was added to the aqueous solution of 'B', a white ppt was obtained that dissolved in excess, giving a colourless solution. 'B' is:

a) $MgSO_4$ b) $Pb(NO_3)_2$ c) $AgNO_3$ d) $ZnSO_4$

**Q46.** A trolley runs from point P to Q along a track, as shown in the figure. At point Q, its potential energy is 50 kJ less than at point P. At point P, the trolley has kinetic energy 5 kJ. Between P and Q, the work done against friction is 10 kJ. What is the kinetic energy at point Q?



a) 35 kJ b) 45 kJ c) 55 kJ d) 65 kJ

**Q47**. Which of the following plant groups lack lignified cell walls in its cellular structure?

a) Bryophytes b) Halophytes c) Pteridophytes d) Spermatophytes

**Q48.** Which of the following is not a simple harmonic motion?

a) Earth moving around Sun
b) pendulum
c) oscillating mass attached to a spring
d) vibrating string of guitar

**Q49.** Gas liquid chromatography cannot be used to separate components which

a) are volatile
b) are non – volatile
c) are liquids
d) vaporize without decomposition

**Q50.** We know that the total amount of DNA from mitochondria and chloroplast will be one-third the quantity of nuclear DNA. It has been found that on an average the chloroplast DNA content is more than the mitochondrial DNA. This is because –

a) mitochondria exhibit polyploidy only in meristems while chloroplasts show polyploidy even during cell maturation
b) the average number of mitochondria in a plant are much less than the number of chloroplasts
c) in general chloroplasts divide much more frequently than the mitochondria
d) all of the above

**Q51.** Which of the following statement is true regarding the Kirchoff's laws?

a) The junction rule is a statement of conservation of energy and the loop rule is a statement of conservation of charge
b) The junction rule as well as the loop rule are statements of conservation of charge.
c) The junction rule as well as the loop rule are statements of conservation of energy.
d) The junction rule is a statement of conservation of charge and the loop rule is a statement of conservation of energy.



**Q52.** You have a large supply of light bulbs and a battery. You start with one light bulb connected to the battery and notice its brightness. You then add one light bulb at a time, each new bulb being added in series to the previous bulbs then

a) Brightness of the bulbs will increase
b) Current through the bulbs will increase
c) Power transferred from the battery will decrease
d) Lifetime of the battery will decrease

**Q53.** 0.1 mole of a weak acid HA and 0.1 mole of its sodium salt are dissolved in water and the solution is made upto 1000 $cm^3$. If $K_a = 1.8 \times 10^{-5}$, the pH of the solution is:

a) 2.4 b) 3.70 c) 4.74 d) 5.00

**Q54.** Stem cells of an adult human being are said to be pluripotent because they have:

a) potential to differentiate into cells of any type
b) potential to reproduce indefinitely
c) potential to differentiate into multiple but not all cell types
d) all of the above

**Q55.** A ray of light is incident on the midpoint of a glass prism surface at an angle of 25.0° with the normal. For the glass, $n = 1.55$, and the angle of prism is 30.0°. What is the angle of incidence at the glass-to-air surface on the side opposite where the ray entered the prism?

a) 14.2°
b) 9.8°
c) 19.2°
d) light will not come out from the other surface

**Q56.** Which of the following has the smallest size?

a) Ne b) $O^{2-}$ c) $F^{-}$ d) $Na^{+}$

**Q57.** A typical dicot possesses tap root system which has a primary root and many lateral roots and rootlets. Which of the following exhibits meristematic activity responsible for production of lateral roots?

a) Vascular cambium
b) Pericycle
c) Endodermis
d) Cork cambium

**Q58.** The ionization energy of nitrogen is more than that of oxygen because of:

a) Greater attraction of nucleus
b) Extra stability of half-filled p-orbitals
c) Smaller size of nitrogen atom
d) Poor shielding effect

**Q59.** A man of mass 100 kg stands on a wood plank of area 4 $m^2$. What is the pressure exerted on the floor? Assume the area of a human foot to be 200 $cm^2$.

a) 500 N b) 25 N c) 50000 N d) 250 N

**Q60**. Human heart consisting of auricles and ventricles and muscular valves is an interesting functional system. The valve regulating the flow of impure blood from the right ventricle to the pulmonary artery is a:

a) Tricuspid valve
b) Semilunar valve
c) Aortic valve
d) Bicuspid valve

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**Section B:** Questions 61 to 68 are of 5 marks each. Marks will also be indicated in the questions if there are more than one part to it.

## SECTION B (Long questions)

**Q61.** The human cerebrum is divided into right and left cerebral hemispheres. The outer 2-4mm of the cerebral hemispheres is known as the cerebral cortex. It consists of grey matter.



The left side of the cerebral cortex receives information from and controls movement of the right side of the body and vice-versa. A thick band of axons known as corpus callosum enables the right and left cerebral cortices to communicate. The left cerebral hemisphere is concerned with recognition of faces.

In a particular patient the corpus callosum was surgically removed as a treatment of last resort for the most extreme form of epilepsy in which fits occurred as often as 30 minutes. The patient appeared normal after recovery but exhibited a 'split-brain' effect.

Answer the following questions using options **(Yes/No).**

1. The patient is blindfolded and given a comb in the left hand. Then the blindfolded person is asked to locate the comb in a mixture of objects (mirror, ball, pen, etc)with his left hand. Will he succeed?

(1 mark)

2. If the doctor asks the blindfolded patient to say what the object was, would he be able to answer?

(1 mark)

3. The doctor asks the blindfolded patient to find the comb in the mixture of objects with his right hand. Would he be successful?

(1 mark)

4. When the blindfolded patient is given the comb in right hand and asked to say what the object is, will he be able to answer?

(1 mark)

5. If the patient is shown a photograph of a familiar face first in the left field of vision and then in the right field, would he be able to put a name to the face, in either field?

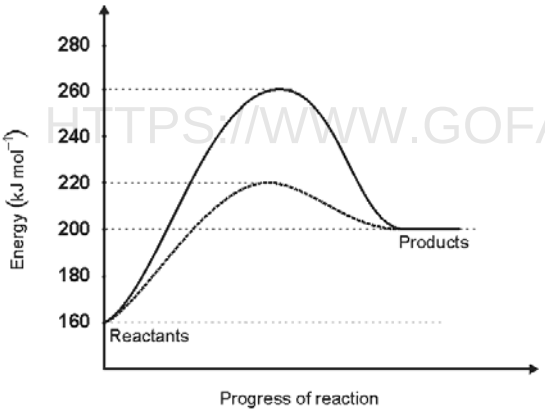
(1 mark)

**Total 5 marks**

**Q62.** Consider the following hypothetical reaction

$$A_2\,(g) + B_2\,(g) \rightleftharpoons 2AB\,(g)$$

and answer the following:






a) Calculate the energy of activation for the forward and backward reactions.

(1 mark)

b) Calculate ΔH (change in enthalpy) for the reaction.

(1 mark)

c) The dotted curve is the reaction path in presence of the catalyst. What is the lowering in activation energy in the presence of the catalyst?

(1 mark)

d) What will be the effect of increased pressure on equilibrium of the above reaction?

(0.5 mark)

e) What will happen if the temperature is increased (raised) by 10°C?

(0.5 mark)

f) State with reason whether the position of equilibrium can be altered using catalyst?

(1 mark)

**Total 5 marks**

**Q63**. **a)** A bus leaves a stop and accelerates at a constant rate for 5.0 seconds. During this time the bus travels 25 meters. After this the bus travels at a constant speed for 15 seconds. Then the driver notices a red light 18 meters ahead and applies brakes with acceleration '$a_b$'. Assume that the bus decelerates at a constant rate and comes to a stop sometime later just at the light.

1. What was the initial acceleration of the bus?
2. What was the velocity of the bus after 5 seconds?
3. Calculate '$a_b$' .
4. How long did does the bus brake?



(2 marks)

**b)** Two athletes Usha and Shiney are playing athletic games. Usha is running at a constant velocity towards Shiney who is stationary. When Usha is 12 meters away from Shiney, Shiney starts to accelerate at a constant rate of $1.5 ms^{-2}$.

1. What is the minimum velocity with which Usha needs to run in order to just catch up with Shiney?
2. How long does Usha take to catch up with Shiney?

(3 marks)

**Total 5 marks**

**Q64. a)** Solve:

$$\frac{3 \times 27^{x+1} + 27 \times 3^{3x}}{3 \times 3^{3x+2} - 1/3 \times 27^{x+1}}$$

(2marks)

**b)** If tan x = b/a,

write $\sqrt{\frac{a+b}{a-b}} + \sqrt{\frac{a-b}{a+b}}$ in terms of cos x.

(3 marks)

**Total 5 marks**

**Q65. a)** A white inorganic solid 'A' on heating with dilute HCl gives a solution 'B' and gas 'C' with smell of rotten eggs. 'B' when treated with dilute NaOH gives a white ppt that dissolves in excess NaOH. Solution 'B' is soluble in dilute $NH_4OH$. On strong heating in air, 'A' gives a pungent gas 'D' and residue 'E' that dissolves in water. A dilute solution of 'E' gives a white ppt 'F' on treatment with $BaCl_2$ solution. Identify A, B, C, D, E, and F.

(3 marks)

**b)** A metal chloride 'X', on treatment with $H_2S$ in acidic medium gives a black ppt. An aqueous solution of X when treated with a solution of $SnCl_2$ gives a white ppt turning grey in excess $SnCl_2$. An aqueous solution of 'X' when treated with aqueous solution of KI gives a red ppt that dissolves in excess KI giving a colourless solution that is used for the detection of cation 'Y'. Identify 'X' and 'Y' with justification. and write all the reactions involved **.**



(2 marks)

**Total 5 marks**

**Q66. a)** There are two conducting plates A and B kept at a distance of 3 mm. Plate A is at +2 Volts and plate B is grounded (0 Volts). An electron begins to move from plate A with an initial velocity of ' *v*'. Find velocity ' *v*' such that the electron travels up to plate B and when it reaches plate B its velocity is zero.

(2 marks)

**b)** A block of ice weighing 20 gm, at -10$^o$C is mixed with 100 gm water at 10$^o$C, in an insulated flask. What is the amount of water, in the flask, when equilibrium is reached?

(3 marks)

**Total 5 marks**

**Q67.** A water body characterized by nutrient rich water supports abundant growth of phytoplanktons and other water plants on its surface. Over time, the water body gets filled with a large number of such plants and the process is called eutrophication. In such water bodies, dissolved oxygen content is nil or very less.

With this information, answer the following questions:

1. Eutrophicated water usually looks turbid green in colour because of:

   a) excessive growth of phytoplanktons
   b) accumulation of minerals and nutrients
   c) water body becoming polluted
   d) release of degraded plant chlorophyll in water

   (1 mark)

2. In eutrophicated water body, growth rate of phytoplanktons is high because of:

   a) light penetrating the lower surfaces of water body
   b) enrichment of nutrients in the water body
   c) less of dissolved oxygen in the water body
   d) aquatic fauna flourishes well in eutrophicated water body

   (1 mark)

3. State whether the following statements are **True** or **False**



   a) Mere increase of nutrients in water body leads to rigorous growth of benthic (plants rooted to the bottom with vegetation either submerged or emergent consisting of plants with their upper parts emerging from water) plants.

   (0.5 mark)

   b) Aquatic fauna thrives well in eutrophicated water body because there are plenty of phytoplanktons on which they could feed on.

   (0.5 mark)

4. The reason for extremely low levels of dissolved oxygen in a eutrophicated water body is:

   a) excessive growth of bacterial decomposers feeding on dead material which consume the dissolved oxygen
   b) plants grow to such a great extent that they do not allow free flow of water hence oxygen in the atmosphere does not get mixed with water
   c) the dissolved oxygen in water reacts with minerals and nutrients to form compounds and hence greatly reduces the quantity of oxygen
   d) oxygen released is consumed by fishes in the eutrophicated water and hence the quantity of dissolved oxygen is very low

   (1 mark)

5. Which of the following biotic organisms will not occur in eutrophicated water bodies?

   a) Phytoplanktons
   b) Zooplanktons
   c) Fishes
   d) Bacteria

(1 mark)

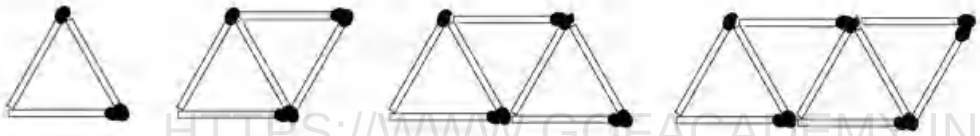
**Total 5 marks**

**Q68. a)** Find a positive integer solution to the following equation. Show your working.

$$x^2 + 615 = 2^n$$

(3 marks)

**b)** Examine the pattern of matchsticks





Find the match sticks required to make the a) $5^{th}$ diagram, b) the $n^{th}$ diagram

(2 marks)

**Total 5 marks**

# Section A

| Q.No. | (a) | (b) | (c) | (d) | Q.No. | (a) | (b) | (c) | (d) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ☐ | ☐ | ☐ | ☒ | 16 | ☐ | ☒ | ☐ | ☐ |
| 2 | ☐ | ☐ | ☒ | ☐ | 17 | ☐ | ☐ | ☐ | ☒ |
| 3 | ☒ | ☐ | ☐ | ☐ | 18 | ☐ | ☐ | ☒ | ☐ |
| 4 | ☐ | ☐ | ☒ | ☐ | 19 | ☐ | ☐ | ☐ | ☒ |
| 5 | ☐ | ☒ | ☐ | ☐ | 20 | ☐ | ☐ | ☐ | ☒ |
| 6 | ☐ | ☐ | ☒ | ☐ | 21 | ☒ | ☐ | ☐ | ☐ |
| 7 | ☐ | ☐ | ☐ | ☒ | 22 | ☒ | ☐ | ☐ | ☐ |
| 8 | ☐ | ☐ | ☒ | ☐ | 23 | ☐ | ☒ | ☐ | ☐ |
| 9 | ☒ | ☐ | ☐ | ☐ | 24 | ☐ | ☒ | ☐ | ☐ |
| 10 | ☐ | ☒ | ☐ | ☐ | 25 | ☐ | ☒ | ☐ | ☐ |
| 11 | ☐ | ☐ | ☐ | ☒ | 26 | ☒ | ☐ | ☐ | ☐ |
| 12 | ☒ | ☐ | ☐ | ☐ | 27 | ☐ | ☒ | ☐ | ☐ |
| 13 | ☐ | ☒ | ☐ | ☐ | 28 | ☐ | ☐ | ☐ | ☒ |
| 14 | ☐ | ☐ | ☐ | ☒ | 29 | ☐ | ☒ | ☐ | ☐ |
| 15 | ☐ | ☐ | ☐ | ☒ | 30 | ☒ | ☐ | ☐ | ☐ |

# Section A (continued)

| Q.No. | (a) | (b) | (c) | (d) | Q.No. | (a) | (b) | (c) | (d) |
|---|---|---|---|---|---|---|---|---|---|
| 31 | ☐ | ☒ | ☐ | ☐ | 46 | ☐ | ☒ | ☐ | ☐ |
| 32 | ☐ | ☐ | ☐ | ☒ | 47 | ☒ | ☐ | ☐ | ☐ |
| 33 | ☐ | ☐ | ☐ | ☒ | 48 | ☒ | ☐ | ☐ | ☐ |
| 34 | ☒ | ☐ | ☐ | ☐ | 49 | ☐ | ☒ | ☐ | ☐ |
| 35 | ☐ | ☐ | ☐ | ☒ | 50 | ☒ | ☐ | ☐ | ☐ |
| 36 | ☐ | ☐ | ☐ | ☒ | 51 | ☐ | ☐ | ☐ | ☒ |
| 37 | ☐ | ☒ | ☐ | ☐ | 52 | ☐ | ☐ | ☒ | ☐ |
| 38 | ☐ | ☐ | ☒ | ☐ | 53 | ☐ | ☐ | ☒ | ☐ |
| 39 | ☐ | ☐ | ☐ | ☒ | 54 | ☐ | ☐ | ☒ | ☐ |
| 40 | ☒ | ☐ | ☐ | ☐ | 55 | ☒ | ☐ | ☐ | ☐ |
| 41 | ☒ | ☐ | ☐ | ☐ | 56 | ☐ | ☐ | ☐ | ☒ |
| 42 | ☐ | ☒ | ☐ | ☐ | 57 | ☐ | ☒ | ☐ | ☐ |
| 43 | ☒ | ☐ | ☐ | ☐ | 58 | ☐ | ☒ | ☐ | ☐ |
| 44 | ☐ | ☒ | ☐ | ☐ | 59 * | ☐ | ☐ | ☐ | ☐ |
| 45 | ☐ | ☐ | ☐ | ☒ | 60 | ☐ | ☒ | ☐ | ☐ |



* **Question 59 has been dropped**

**INJSO Answer key**

**PART B**

**Ans 61.**

Each part carries 1 mark

1. y
2. n
3. n
4. y
5. n

**Ans 62.**
**a)**

| Without catalyst | or | With catalyst |
|---|---|---|
| Threshold energy = 260 KJmol$^{-1}$ | | Threshold energy = 220 KJmol$^{-1}$ |
| Energy of reactants = 160 KJmol$^{-1}$ | | Energy of reactants = 160 KJmol$^{-1}$ |
| $E_a$ (forward) = $E_t$ - $E_r$ = 260 – 160 = 100 KJmol$^{-1}$ | | $E_a$ (forward) = $E_t$ - $E_r$ = 220 – 160 = 60 KJmol$^{-1}$ |
| Energy of products = 200 KJmol$^{-1}$ | | Energy of products = 200 KJmol$^{-1}$ |
| $E_a$ (backward) = $E_t$ – $E_p$ = 260 – 200 = 60 KJmol$^{-1}$ | | $E_a$ (backward) = $E_t$ – $E_p$ = 220 – 200 = 20 KJmol$^{-1}$ |



**b)** Energy of reactants $A_2$ and $B_2$ = 160 KJmol$^{-1}$

Energy of products AB = 200 KJmol$^{-1}$

$\Delta H = E_p - E_r$
$= 200 – 160 = 40$ KJmol$^{-1}$

Hence the reaction is endothermic.

**c)** In the presence of catalyst threshold energy becomes 220 KJmol$^{-1}$

$E'_a$ (forward) = 220 – 160 = 60 KJmol$^{-1}$

$E'_a$ (backward) = 220 – 200 = 20 $KJmol^{-1}$

Hence, Lowering in activation energy = 60 – 20 = 40 $KJmol^{-1}$

**d)** As the reaction does not involve any change in number of moles of gaseous species hence **increased pressure does not have any effect on equilibrium.**

**e)** If temperature is raised by 10°C the rate of reaction will become double.

**f) Method I :**

In the presence of catalyst threshold energy becomes 220 $KJmol^{-1}$

$E'_a$ (forward) = 220 – 160 = 60 $KJmol^{-1}$
$E'_a$ (backward) = 220 – 200 = 20 $KJmol^{-1}$

$E_a$ (forward) - $E'_a$ (forward) = 100 – 60 = 40 $KJmol^{-1}$
without catalyst with catalyst



$E_a$ (backward) - $E'_a$ (backward) = 60 – 20 = 40 $KJmol^{-1}$
without catalyst with catalyst

Position of equilibrium will remain same because activation energy for the forward reaction and the backward reaction have decreased equally.

**OR**

**Method II :**

$E_a$ (in absence of catalyst) = 260 – 160 = 100 $KJmol^{-1}$

$E'_a$ (in presence of catalyst) = 220 – 160 = 60 $KJmol^{-1}$

Lowering in activation energy = $E_a$ - $E'_a$ = 100 – 60 = 40 $KJmol^{-1}$

**OR**

**Method III :**

Energy of activation in absence of catalyst is 260 $KJmol^{-1}$

Energy of activation in presence of catalyst is 220 $KJmol^{-1}$

Hence, Lowering in activation energy is $260 - 220 = 40$ KJmol$^{-1}$

**Ans 63.**

**a)**

1. $a = \frac{2s}{t} = \frac{2(2s)}{(5)^2} = 2 m/s^2$

Now, $a = 2 m/s^2$ $\Rightarrow s_1 = 25$ m

2. $v = a \times t = 2 \times 5 = 10$ m/s $\Rightarrow s_2 = 150$ m

3. $a = -\frac{v^2}{2s} = -\frac{1}{2} \times \frac{10^2}{18} = -2.78 m/s^2$ It is negative

4. $18 = \frac{1}{2} \times 2.78 \times t^2 \Rightarrow t = 3.60$ sec

Also, $s_3 = 17.98 \approx 18$ m

**b)**



$v_u$ = const
$a_s = 1.5$ m/s
$x_u - x_s = 12$ m
Usha catches up with Shiney after time t
$x_u = v_u \times t$
$x_s = 0.5\ a_s.t^2$
$v_u\ t - 0.75\ t^2 = 12$

at time t, $v_u = v_s = 1.5$ t (since Usha is over taking Shiney)

$1.5\ t^2 - 0.75\ t^2 - 12 = 0$
$0.75\ t^2 = 12$
$t = 4$ sec
$v_u = at = 6$ m/s

**Ans 64.**

**a)** $\dfrac{3 \times (3^{\frac{3}{3x+2}})^{x+1} + (3^{\frac{3}{3x}}) \times 3^{\frac{3x}{3x+2}}}{3 \times 3^{3x+2} - (1/3)(3^{3})^{x+1}}$

$= \dfrac{3 \times 3^{\frac{3x+3}{3x+3}} + 3^{\frac{3}{3x+3}} \times 3^{\frac{3x}{3x+3}}}{3^{3x+3} - 1/3 \times 3^{3x+3}}$

$= \dfrac{3^{\frac{3x+3}{3x+3}}(3+1)}{3^{3x+3}(1-1/3)} = \dfrac{4}{2/3} = 6$

**b)**

$\dfrac{a+b}{a-b} + \dfrac{a-b}{a+b}$

$= \dfrac{a+b}{a-b} + \dfrac{1}{\sqrt{\dfrac{a+b}{a-b}}}$

$= \dfrac{\left(\dfrac{a+b}{a-b}\right) + 1}{\sqrt{\dfrac{a+b}{a-b}}} = \dfrac{2a}{\sqrt{a-b} \times \sqrt{a+b}}$

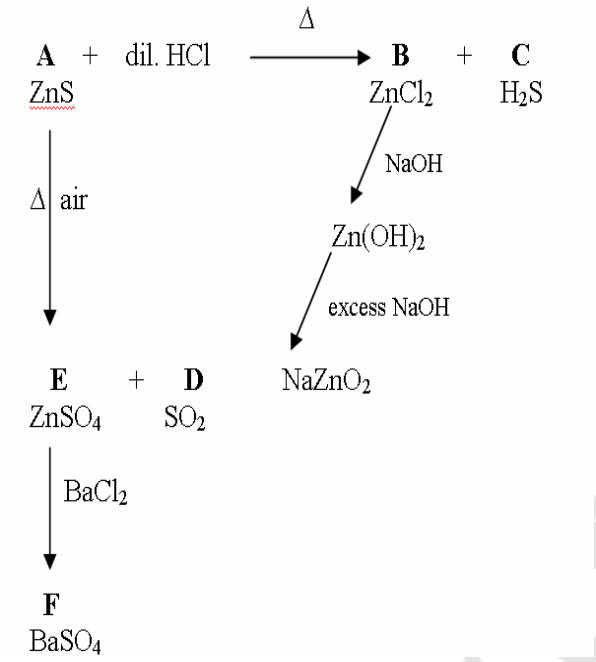


$= \dfrac{2a}{\sqrt{1-\tan x} \times \sqrt{1+\tan x}} = \dfrac{2\sqrt{\cos x}}{\sqrt{\cos^2 x - \sin^2 x}}$

$= \dfrac{2\cos x}{\sqrt{\cos 2x}} = \dfrac{2\cos x}{\sqrt{2\cos^2 x - 1}}$

**Ans 65.**

**a)**




**b)** **X ≡ $HgCl_2$ Y ≡ $NH_4^+$**



$HgCl_2 + H_2S \xrightarrow{H^+} HgS\downarrow + 2HCl$ (Black ppt)

$HgCl_2 + SnCl_2 \longrightarrow Hg_2Cl_2\downarrow + SnCl_4$ (White ppt)

$Hg_2Cl_2 + SnCl_2 \longrightarrow Hg + SnCl_4$

$HgCl_2 + KI \longrightarrow HgI_2\downarrow \xrightarrow{KI} K_2HgI_4$ ($HgI_2\downarrow$ (red); $K_2HgI_4$ (colourless soln.))

**Ans 66.**

**a)** $0.5\ mv^2 = q\ (2-0)$

$v = 8.4 \times 10^5$ m/s

($8.3 \leftarrow\rightarrow 8.5 \times 10^5$ m/s

($8.0 \leftarrow\rightarrow 8.3$ and $8.5 \leftarrow\rightarrow 8.8 \times 10^5$ m/s

**b)** Heat required to raise the temp. of ice to $0^oC = 20 \times 0.5 \times 10 = 100$ cal

Heat supplied by water coming to $0^oC = 100 \times 1 \times 10 = 1000$ cal

Remaining heat to melt ice = 900 cal

Amount of ice that will melt = 900 / 80 = 11.25 gm

Total water amount at end = 111.25gm



**Ans. 67**

1. a)
2. b)
3. a)False b)False
4. a)
5. c)

**Ans 68.**

**a)** $2^n - 615$ is positive
n =12

**b)**
a) 11
b) 2n + 1

# INJSO – 2011 (Answer Key)
## Section A (Multiple Choice Questions)

| Q.No. | Ans. |
|---|---|
| 1 | a |
| 2 | b |
| 3 | d |
| 4 | a |
| 5 | a |
| 6 | b |
| 7 | c |
| 8 | b |
| 9 | a |
| 10 | a |
| 11 | a |
| 12 | a |
| 13 | c |
| 14 | d |
| 15 | b |
| 16 | c |
| 17 | a |
| 18 | b |
| 19 | a |
| 20 | b |
| 21 | d |
| 22 | a |
| 23 | c |
| 24 | c |
| 25 | b |
| 26 | c |
| 27 | d |
| 28 | b |
| 29 | a |
| 30 | b |
| 31 | d |
| 32 | c |
| 33 | b |
| 34 | b |
| 35 | a |
| 36 | a |
| 37 | c |
| 38 | c |
| 39 | c |
| 40 | c |
| 41 | b |
| 42 | c |
| 43 | c |
| 44 | c |
| 45 | b |
| 46 | b |
| 47 | a |
| 48 | a |
| 49 | a |
| 50 | c |
| 51 | b |
| 52 | b |
| 53 | c |
| 54 | d |
| 55 | b |
| 56 | c |
| 57 | b |
| 58 | d |
| 59 | d |
| 60 | b |

## Section B (Long Answer Questions)

***Please note that alternate/equivalent solutions may exist.***

**61. 1.** (d) All solutions have lower water potentials than pure water and have negative values of $\psi$ .

**2.** $\psi_p$ of a flaccid cell is zero.

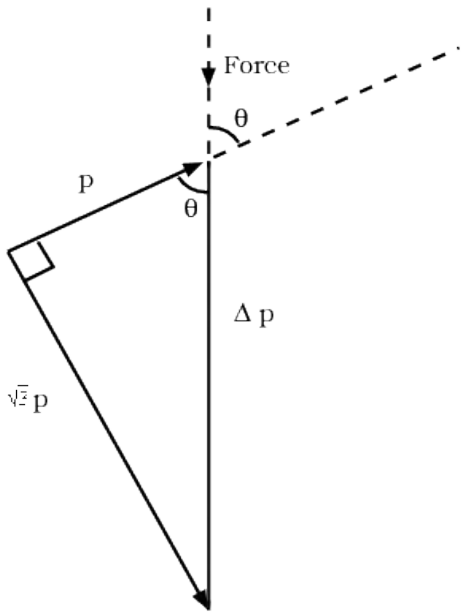
**3.** A) Cell B
B) Cell B to Cell A

**4.** $\psi$ = -1000 kPa

**5.** $\psi_p$ at equilibrium

| Cell A | Cell B |
|---|---|
| $\psi = \psi_s + \psi_p$<br>= -1000 kPa - (-2000 kPa)<br>= 1000 kPa | $\psi = \psi_s + \psi_p$<br>= -1000 kPa - (-1400 kPa)<br>= 400 kPa |

**62. a)** Let the initial momentum be 'p'
$\therefore$ Final momentum is $\sqrt{3}p$
Angle turned is 90°. To find $\angle\theta$, (refer the diag.)

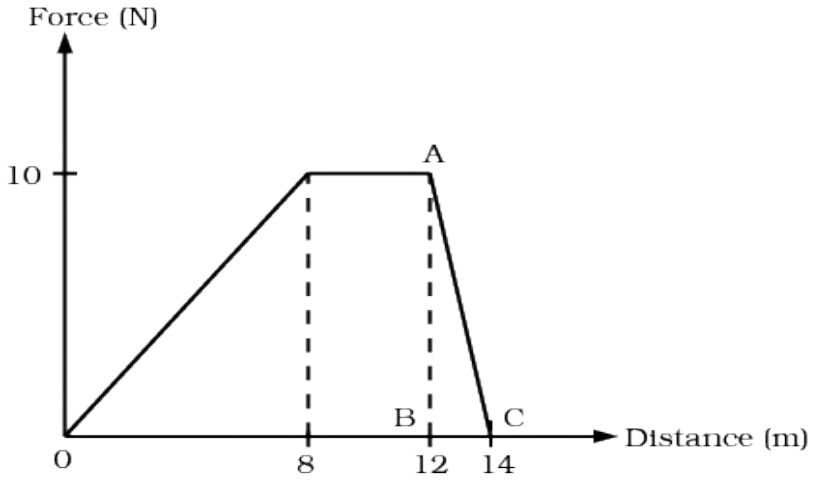



As per the momentum diagram,
using Newton's second law,
Force acts in direction of change in momentum Δp

$\therefore \tan\theta = \frac{\sqrt{3}p}{p} = \sqrt{3}$

$\therefore \theta = 60°$

**b)**




Work done over the distance of last 2m = Area of Δ ABC

$= ½ \times 2 \times 10$

$= 10$ J

**63. a)** Element is Chromium, Cr (24)

Electronic configuration: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$

**b)** Four s sub shells, two p sub shells, one d sub shell ; 15 orbitals and 6 unpaired electrons

**c)** 12 and 5 respectively

**d)** one

**e)** one

**64.** 2! = 2

3! = 6

4! = 24

5! = 120

And all subsequent factorials have last digit zero.

So, 1+ 2 + 6 + 24 = 33

Hence, last digit will be 3.

**65. i)** $\rho_i = 917$ kg·m$^{-3}$

$\rho_w = 1000$ kg·m$^{-3}$

$\rho_o = 1024$ kg·m$^{-3}$

When iceberg floats, $\rho_i V_i = \rho_o V_o$ where $V_i$ is iceberg's volume and $V_o$ is displaced water.

$$V_o = \frac{\rho_i V_i}{\rho_o}$$

$$h \times A = \frac{\rho_i V_i}{\rho_o}$$

where, h = rise in sea level

A = surface area of the sea

$$h = \frac{4 \times 10^3 \times 917 \times 10^9}{3.61 \times 10^8 \times 10^6 \times 1024} \approx 10^{-2} \text{ m} = 1 \text{ cm}$$

**ii)** After melting

$$\rho_i V_i = \rho_w V_w \quad \Rightarrow \quad V_w = \frac{\rho_i V_i}{\rho_w}$$

where $V_w$ is the volume of water after melting.

$$V_w - V_o = V_i \rho_i \left(\frac{1}{\rho_w} - \frac{1}{\rho_o}\right)$$

$$= V_i \frac{\rho_i(\rho_o - \rho_w)}{\rho_o \rho_w} = V_i \frac{917 \times 24}{1.024 \times 10^6}$$

$$A \times h = \frac{0.4 \times 10^{13} \times 917 \times 24}{1.024 \times 10^6} = 8.57 \times 10^{10}$$

$$h = \frac{8.57 \times 10^{10}}{3.61 \times 10^8 \times 10^6} = 2.38 \times 10^{-4} \text{m} = 0.24 \text{ mm}$$

**iii)** Water surface area = $\frac{3.61 \times 10^8}{4\pi(6.4)^2 \times 10^{12}} \approx 70\%$

**66. a)** Any natural number is of the form 2n or 2n+1,

where n is a non-negative integer. Now $(2n)^2 = 4n^2$ is divisible by 4

and $(2n+1)^2 = 4n(n+1) + 1$ leaves 1 as remainder upon division by 4.

**b)** A simple calculation reveals that n! + 2 = 3,4,8 for n = 1,2,3.

Thus for n = 2 the expression n!+2 is a square of a natural number.

For n greater than 3, n! is divisible by 4.
Therefore the remainder obtained upon dividing n!+2 by 4 is 2.

Hence it cannot be a perfect square.

Therefore the only value of n that makes n!+2 a perfect square is 2.

**67. a)** (i) 28 $cm^3$
(ii) 3
(iii) $[HNO_3] = 2.80 \times 10 - 3 \div 0.025$
$= 0.112$ mol $dm^{-3}$

**b)**

$S + 3/2\ O_2 \rightarrow SO_3$
$SO_2 + ½\ O_2 \rightarrow SO_3$

$S + 3/2\ O_2 \rightarrow SO_3 \qquad \Delta H_1 = -395$ kJ
$SO_3 \rightarrow SO_2 + ½\ O_2 \qquad \Delta H_2 = +98$ kJ

$S(s) + O_2(g) \rightarrow SO_2$

$\Delta H$ (final) = $\Delta H_1 + \Delta H_2$
= -395 + 98
**= -297 kJ**

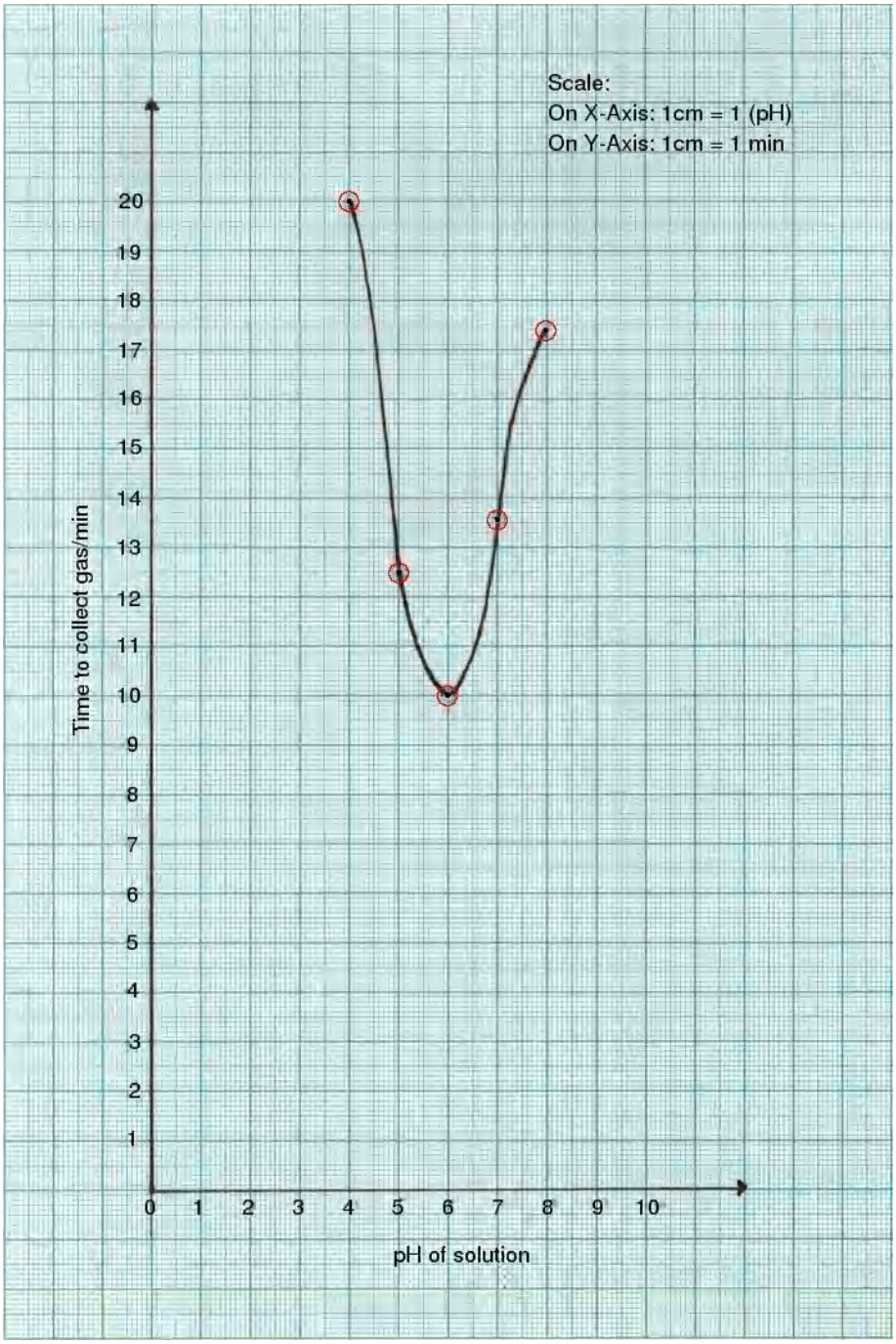
**68. 1.** pH = 5.5

**2.** a) Activity curve A – Pepsin (2.00)
b) **Omitted**

**3.** The active site of the enzyme is being destroyed. The ionisable groups of the enzyme, especially those of the active site, are being modified. Hence the substrate no longer fits easily into the active site and catalytic activity is diminished.

**4.**

| pH of solution | Time to collect gas/min |
|---|---|
| 4 | 20 |
| 5 | 12.5 |
| 6 | 10 |
| 7 | 13.6 |
| 8 | 17.4 |




**5.** pH = 6.00

**6.** From pH 4 to 6, ionisable groups of the active site becomes more efficient at receiving and complexing with the substrate. The reverse is true when pH changes from 6 to 8.