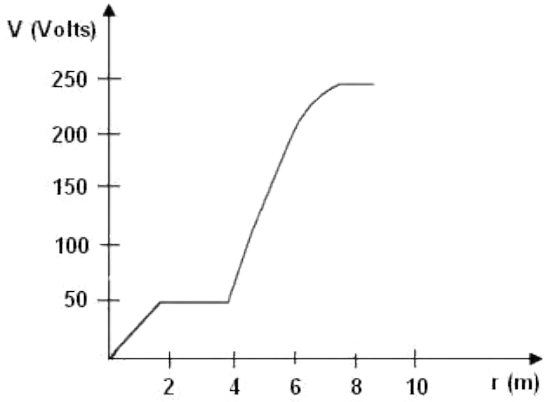
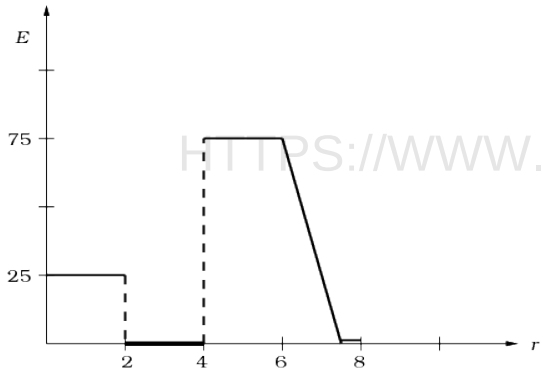
Questions (INJSO 2011)

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

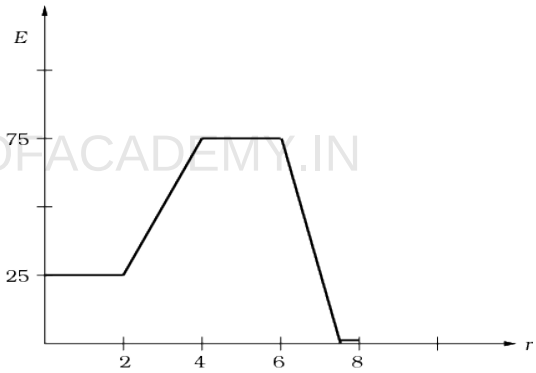
SECTION A

1. A potential difference vs distance graph is given. Choose the correct option for the electric field vs. distance graph from the given options:





a)



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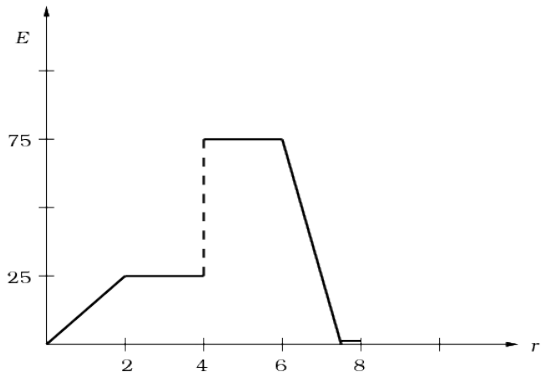
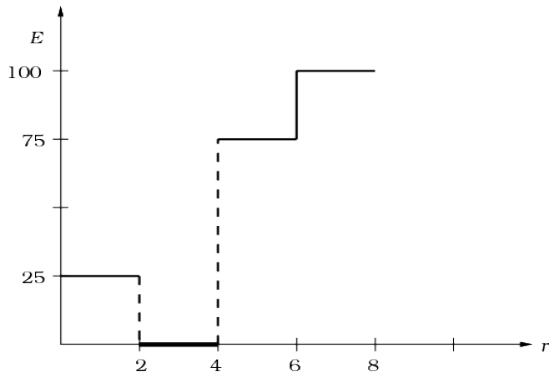


c)

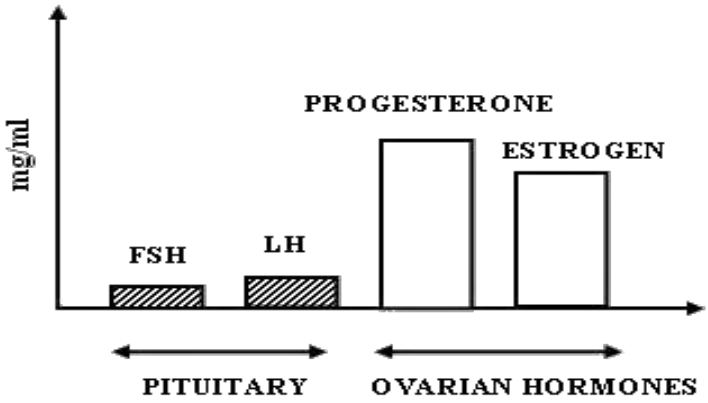


d)

2. Separate solutions of HCl (aq) and H_2SO_4 of the same molar concentration and same volume were completely neutralized by NaOH (aq). *X* KJ and *Y* KJ of heat were evolved respectively. Which statement is correct?

a) $X = Y$
b) $Y = 2X$
c) $X = 2Y$
d) $Y = 3X$

3. The figure below gives the level of ovarian and gonadotropic hormone in a blood sample of a normal healthy female of 35 years.



According to you, which phase of menstrual cycle was she undergoing at the time of blood test?

a) Menstrual phase
b) Proliferative phase
c) Ovulatory phase
d) Luteal or Secretory phase

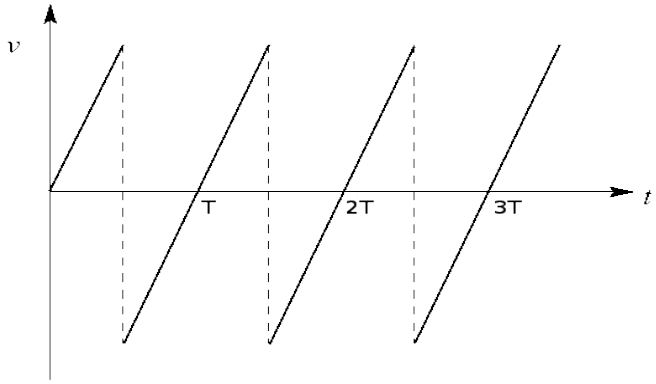
4. Muscles containing large amounts of Myoglobin are likely to be found in a...

a) marathon runner
b) 100 m sprinter
c) high jumper
d) gymnast

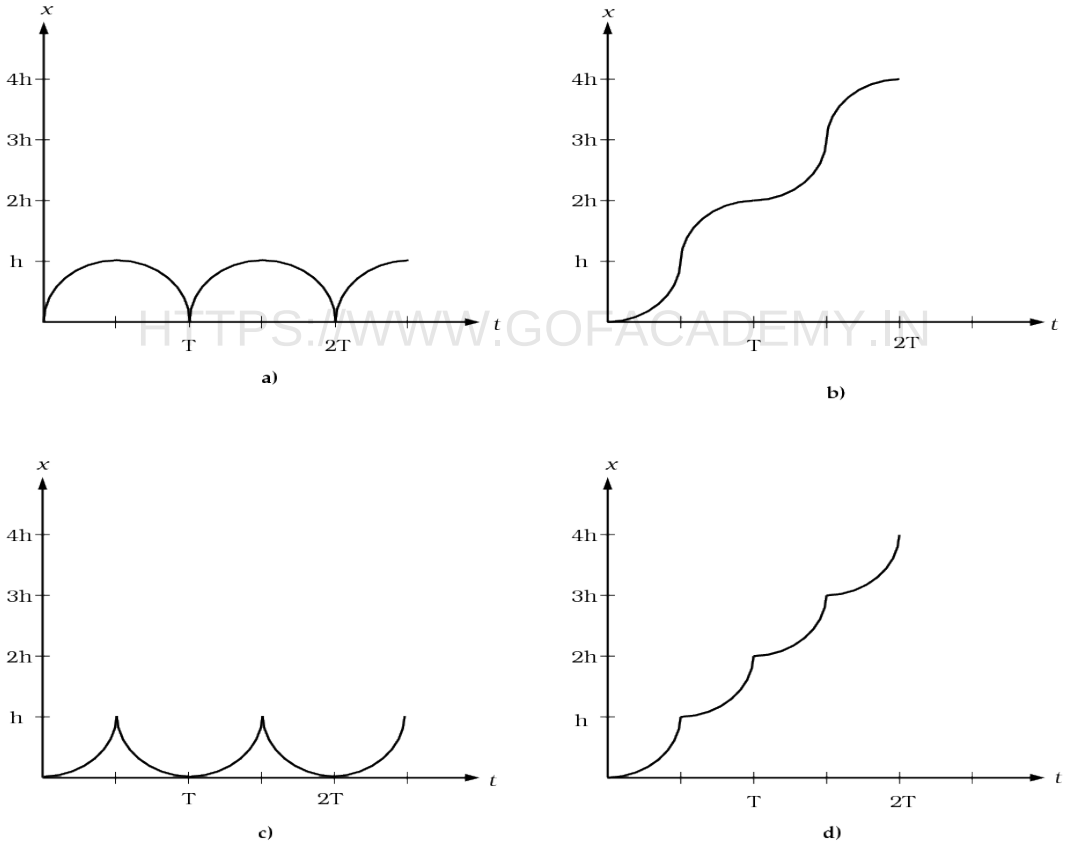
5. The maximum number of Hydrogen bonds in which hydrogen fluoride molecule can participate are:

a) 2 b) 3 c) 4 d) 5

6. A ball is dropped from a height h on a floor and suffers multiple perfectly elastic bounces. The velocity vs t graph is as shown. Here time T depicts the time required to complete one cycle.



Which of the following graph correctly shows the cumulative distance vs time?



7. When unequal number of unpaired electrons are aligned in opposite direction, then the net magnetic moment is not zero. Such substances are termed as-

a) diamagnetic b) ferromagnetic c) ferrimagnetic d) antiferromagnetic

8. A man of height h walking away from a lamp post finds his shadow to be equal to his height when he is at a distance x from the lamp post. If the height of the lamp post is H, then x is

a) H + h b) H – h c) H.h d) H /h

9. Anil, an 8th grade student, was asked to draw a figure explaining how the mammalian eye collects and focuses light, converting it into electrical signals. Which of the following flow charts correctly represents the process?

a) Light → Cornea → Aqueous humor → Pupil → Lens → Vitreous humor → Retina → Action potentials in neurons → Optic nerve → Brain.

b) Light → Sclera → Vitreous humor → Pupil → Lens → Aqueous humor → Retina → Action potentials in neurons → Optic nerve → Brain.

c) Light → Sclera → Cornea → Aqueous humor → Pupil → Lens → Vitreous humor → Retina → Action potentials in neurons → Optic nerve → Brain.

d) Light → Cornea → Aqueous humor → Iris → Lens → Vitreous humor → Retina → Action potentials in neurons → Optic nerve → Brain.

10. In a housing society, a water pump of efficiency 80% is used to lift water upto the overhead tank. It lifts 3600 kg water in 10 minutes. The pump is run on an electric motor having efficiency 75%. Calculate horse power of the motor. Water tank is 30 m above the basement tank level.

a) 4 HP b) 240 HP c) 3.2 HP d) 2.4 HP

11. When a compressed gas is allowed to expand through a small orifice cooling effect is caused if

a) the temperature of the gas is less than the inversion temperature (T_i)
b) the temperature of the gas is greater than the inversion temperature (T_i)
c) the temperature of the gas is equal to the critical temperature
d) the temperature of the gas is 273K.

12. As we know, a code of three nitrogen bases is responsible for specifying one amino acid. In an ideal case, how many nitrogen bases would be present on a messenger RNA that transcribes a polypeptide containing 57 amino acids?

a) 174
b) 168
c) 171
d) 19

13. A student adds 5.85 gm of NaCl to 1 litre of water (the pH of which was measured to be 7.0) in a flask (X) to make a 0.1 M solution. He transfers 500 ml into another flask (Y). He covers the flask (Y) with tissue paper and the original flask (X) with a watch glass and goes to watch a movie. When he returns to the lab the next morning, he checks the pH of both the solutions using a perfectly calibrated pH meter. Which of the following is correct?

a) X has pH = 7 and Y has pH > 7
b) X has pH < 7 and Y has pH = 7
c) X has pH = 7 and Y has pH < 7
d) Both X and Y have pH = 7

14. Some epiphytes are also referred to as "space parasites" because they

a) compete with the species on which they are growing for food.
b) occupy large land space.
c) take food and support from the plant on which they are growing.
d) may choke the species supporting them by their luxuriant growth.

15. Perpetual motion of a body cannot be achieved on earth as it violates the law of
i) conservation of momentum
ii) conservation of energy
iii) law of conservation of mass
Which of the above is/are in correct?

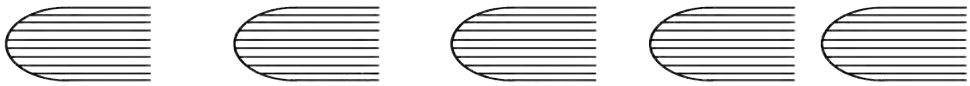
a) only i
b) only ii
c) i and ii
d) i, ii and iii

16. Two species live in the same locale but each one reproduces at different time of the year & both do not attempt to mate each other. This can be considered as an example of:

a) gamete isolation
b) mechanical isolation
c) behavioral isolation
d) hybrid sterility

17. A crystalline substance 'A' gave a precipitate when treated with barium nitrate. The aqueous solution of 'A' gave yellow colour with methyl orange indicator. The substance 'A' could be
a) K_3PO_4
b) $(NH_4)_2SO_4$
c) NaCl
d) $CaCl_2$

18. A vehicle is moving on a road. Ink drops are falling, one at a time, on the road from the vehicle. After the vehicle has moved away, what one observes is shown (qualitatively) in the figure given below. From the figure we can conclude about the vehicle to be moving...



a) from left to right with increasing speed
b) from left to right with decreasing speed
c) from right to left with increasing speed
d) from right to left with decreasing speed

19. A space station is made to spin about an axis such that the astronauts inside feel their normal weight W against the outermost wall. When they are at a level at half the distance from the axis of rotation as the outermost wall, they will feel the weight as

a) ½W b) ¼W c) W d) 4W

20. A few pairs of fruits are mentioned below. Using the criteria of classification of fruits, find the odd pair out.

a) Pea, Bean b) Custard apple, Fig c) Pineapple, Jackfruit d) Coconut, Mango

21. Which of the following solutions will have pH close to 1.0?

a) 100 mL 0.1 M HCl + 100 mL 0.1 M NaOH
b) 55 mL 0.1 M HCl + 45 mL 0.1 M NaOH
c) 10 mL 0.1 M HCl + 90 mL 0.1 M NaOH
d) 75 mL 0.2M HCl + 25 mL 0.2 M NaOH

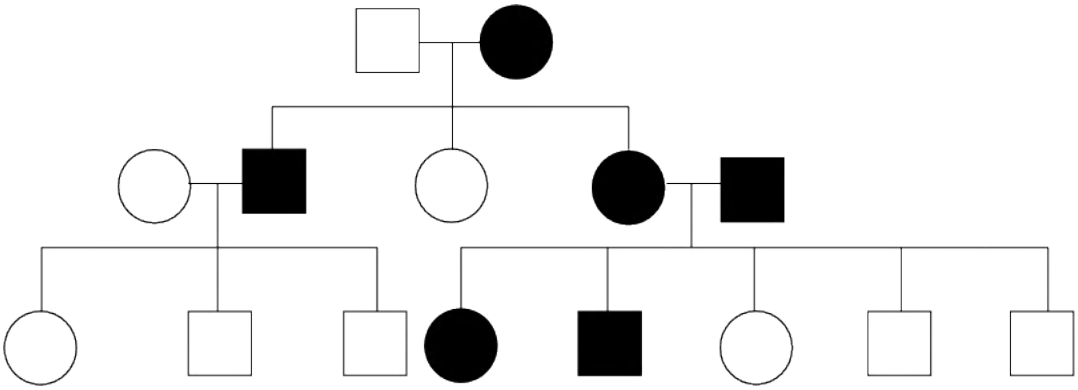
22. A block of mass 5 kg is to be dragged along a rough horizontal surface having $\mu_s = 0.5$ and $\mu_k = 0.3$. The horizontal force applied for dragging it is 20 N. Acceleration of the block in m/s^2 and frictional force acting on the block in N are respectively

a) 0, 20 b) 30, 15 c) 30, 25 d) 0, 15

23. The pKa of aspirin, a weak acid, is 3.5. The pH of gastric juice in the human stomach is between 2 and 3, while that in the small intestine is about 8. Aspirin will be...

a) unionized in the small intestine and the stomach
b) completely ionized in the small intestine and the stomach
c) ionized in the small intestine and almost unionized in the stomach
d) ionized in the stomach and almost unionized in the small intestine

24. In the following cross, the character indicated by males (darkened squares) and females (circle) is...



a) X- linked dominant
b) X- linked recessive
c) an autosomal dominant
d) an autosomal recessive

25. Had Newton and Einstein shaken their hands, which fundamental force they would have exerted on each other (During shaking their hands)?

a) Frictional b) Electromagnetic c) Gravitational d) Mechanical

26. The compound whose 0.1 M solution is basic is
a) Ammonium acetate
b) Ammonium chloride
c) Sodium acetate
d) Sodium sulphate

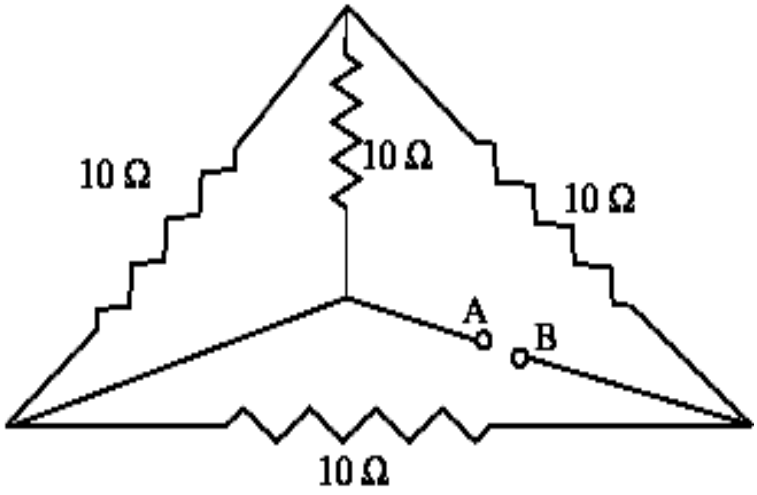
27. A DNA molecule has the sequence CAT CAT CAT. If a guanine base is added at the beginning of the sequence, which of the following would be the MOST appropriate option –

a) G CAT CAT CAT
b) GCA TCA TCA T
c) Frame shift mutation
d) both b and c

28. What will be the volume of Cl_2 at STP produced during electrolysis of $MgCl_2$ which produces 6.5g Mg (At.wt. of Mg = 24.3g, Cl = 35.5g)

a) 5.099 litre b) 5.99 litre c) 12.02 litre d) 3.099 litre

29. Calculate equivalent resistance between points A and B in the following circuit.

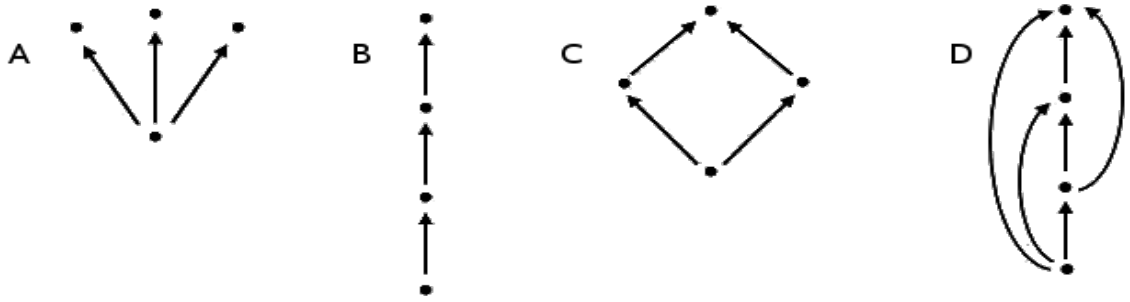


a) 6Ω b) 2.5Ω c) 40Ω d) None of these

30. It is known that among corn plants, a tall plant (T) trait is dominant over dwarf (t), and the coloured kernel (C) trait is dominant is over white (c). Which of the following results represents the outcome of a cross between contrasting dihybrid parents?

a) F2 generation has 5 homozygous and 11 heterozygous individuals.
b) F2 generation has 4 homozygous, 4 double heterozygous and 8 intermediates.
c) F2 generation has all dominant forms of morphological characters.
d) F2 generation has all recessive forms of morphological characters.

31. Each of the following four visuals represent food chains. The lowermost dot in each of the visual represents autotrophs. Observe them carefully and select the one which represents the most stable ecological community.



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

32. A certain quantity of a gas occupies a volume of 0.1 L When collected over water at 10˚C and a pressure 0.90 atm. The same gas occupied a volume of 0.080 L at STP in dry conditions. Calculate the aqueous tension at 10˚C.

a) 0.061 b) 0.051 c) 0.071 d) 0.081

33. Force (F), velocity (v), time (T) and temperature (θ) are chosen as fundamental quantities. Obtain dimensions of specific latent heat.

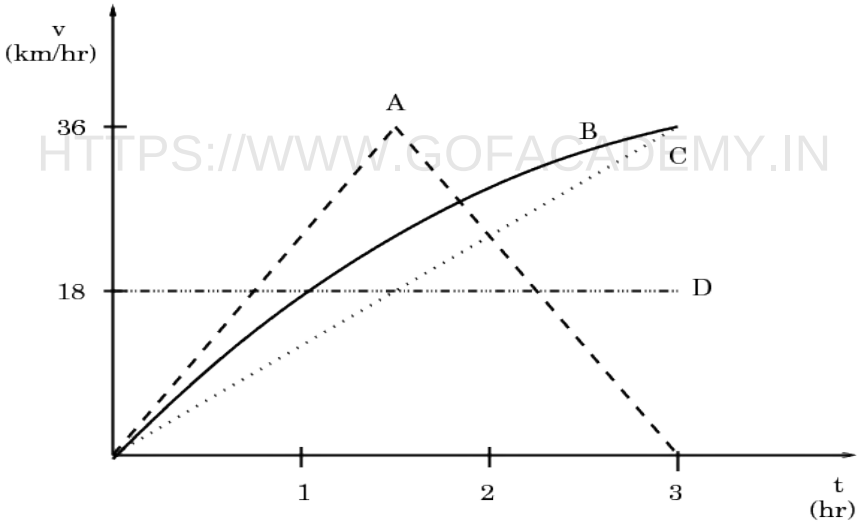
a) $[v^2\theta^{-1}]$

b) $[v^2]$

c) $[FvT^{-1}\theta^{-1}]$

d) $[FvT^{-1}]$

34. Velocity time graph of four athletes for a given interval of time are as given below. Who has travelled maximum distance?

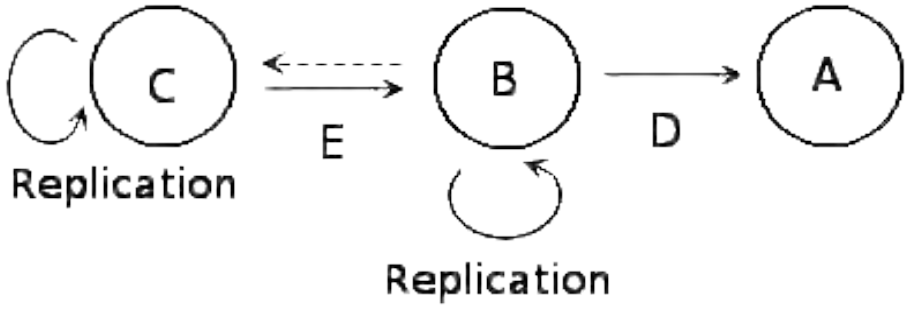


a) A b) B c) C d) D

35. A certain sample of concentrated hydrochloric acid contains 50% HCl by mass and has density 1.20 gcm^{-3}. What is the molarity of this sample?

a) 16.4 M b) 8.2 M c) 32.8 M d) 13.4 M

36. The diagram below represents the 'Central Dogma' of molecular biology. Choose the correct combination of labeling.



a) A = Protein, B = RNA, C = DNA, D = Translation, E = Transcription
b) A = RNA, B = DNA, C = Protein, E = Transcription, D = Translation
c) A = Translation, B = DNA, C = Protein, D = Transcription, E = RNA
d) A = DNA, B = RNA, C = Protein, D = Transcription, E = Translation

37. Which of the following is an *ex situ* method of conservation?

a) Agro-forestry
b) Sanctuary
c) Cryopreservation
d) Biosphere reserve

38. Three plane mirrors are kept mutually perpendicular. From a certain point in front of them, a ray of light is incident on 1st mirror in such a way that it is successively reflected from 1st, 2nd and 3rd mirror. The ray after reflection from 3rd mirror will be

a) passing through the same point.
b) perpendicular to the initial ray.
c) parallel to the initial ray.
d) along any direction depending upon initial angle of incidence.

39. In the reaction

i) $BaO_2(s) + O_3(g) \longrightarrow BaO(s) + 2O_2(g)$

ii) $ZnS(s) + 4O_3(g) \longrightarrow ZnSO_4(s) + 4O_2(g)$

a) O_3 is reduced both in i) & ii)
b) O_3 is oxidized both in i) & ii)
c) O_3 is oxidized in i) & reduced in ii)
d) O_3 is reduced in i) & oxidized in ii)

40. Alum helps in purifying water by

a) Forming Silicon complex with clay particles
b) Sulphate part which combines with dirt and removes it
c) Compound of Aluminium which coagulates the mud particles.
d) Making mud water soluble

41. Assume that there is a set of triplets in which two of them were identical, separated at birth and were brought up by different families. After 25 years, the three individuals were traced and brought together. The following data was recorded. Study the data carefully and infer which are the identical twins.

Traits	***Person 'A'***	***Person 'B'***	***Person 'C'***
Height	190 cm	190 cm	180cm
Weight	60 Kg	65Kg	75 Kg
Blood group	O	AB	O
Measure of intelligence	135	140	125
Skin colour	White	White	Dark

a) AB b) AC c) CB d) BC

42. Three identical electric bulbs are connected parallel to each other. On connecting their combination across a source of emf having stabilized voltage and negligible resistance, all bulbs glow with full brightness. Suddenly a bulb fuses. The other bulbs will glow..

a) brighter
b) dimmer
c) with same initial intensity
d) zero, as those will also fuse.

43. You are given two identical steel pieces A and B and only one of those is magnetized. In all the following arrangements, there is attraction between A and B. Which of the following arrangements helps us in identifying the magnet?

a) b) c) d)

44. Rust is a mixture of
   a) FeO and $Fe(OH)_3$
   b) FeO and Fe_3O_4
   c) Fe_2O_3 and $Fe(OH)_3$
   d) $Fe(OH)_3$ and Fe_3O_4

45. Shirin had been on a holiday to Ooty. In her school, she has studied about the interesting world of plants. On the day of her return she collected four groups of plants – I, II, III and IV. She carefully noted some of their details and arranged the information in the form of a table as given below. Her teacher agreed to tell her descriptions about all plants if she could by looking at the information in the table say which of the groups of plants she collected represented pteridophytes. Take a look at the data and suggest which of the groups could be of pteridophytes.

Sr	***Characters***	***Plant group I***	***Plant group II***	***Plant group III***	***Plant group IV***
1.	Autotrophic	Yes	Yes	No	No
2.	Terrestrial	No	Yes	Yes	Yes
3	Presence of vascular tissue	No	Yes	Yes	No
4.	Flowers produced	No	No	Yes	No

   a) Plant group I
   b) Plant group II
   c) Plant group III
   d) Plant group IV

46. If the product of the gas constant R and NTP temperature (in Kelvin) is 22.4, the compressibility factor of the gas at 1 atmospheric pressure is

   a) greater than one b) one c) less than one d) zero

47. From a distance much greater than 2R (R = Radius of curvature), a real object is brought close to a convex mirror. Distance between object and the image

   a) throughout decreases
   b) throughout increases
   c) decreases upto f
   d) first decreases then increases

48. A pure dwarf *Pisum sativum* (pea) plant was treated with Gibberrelic Acid (GA_3). It then becomes tall. If this plant is crossed with a pure tall plant, what will be the phenotype in the next generation.

a) 100% tall
b) 50% tall and 50% dwarf
c) 75% tall and 25% dwarf
d) 100% dwarf

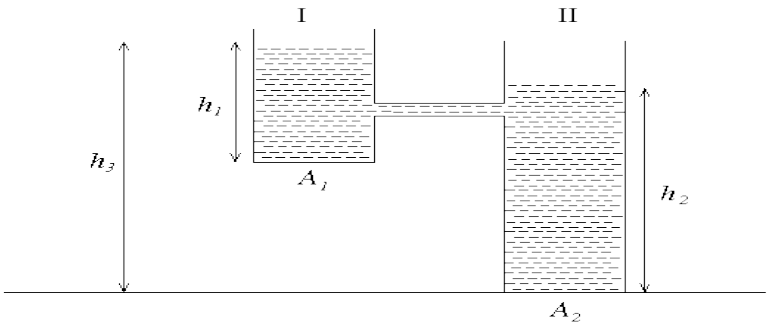
49. In the following table, column A represents different proteins and column B has examples of the proteins. Choose among the given options the most appropriate match for proteins in column A with examples in column B?

Column A	**Column B**
A) Keratin	(i) Silk
B) Collagen	(ii) Hooves
C) Fibroin	(iii) Peroxidase
D) Globular	(iv) Ligaments

a) A)-(ii); B)-(iv); C)-(i); D)-(iii)
b) A)-(ii); B)-(iii); C)-(iv); D)-(i)
c) A)-(i); B)-(iv); C)-(ii); D)-(iii)
d) A)-(iv); B)-(ii); C)-(i); D)-(iii)

50. In the figure shown below, there are two tanks I and II with cross-sectional area A_1 and A_2, respectively. The rate of flow of water between I and II will depend on

i) h_2-h_3 ii) h_1-h_2 iii) A_2/A_1



Which of the above options are correct?

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

51. In the Haber process for the synthesis of ammonia, amount of ammonia formed will be more if:
   a) pressure is decreased and temperature is increased
   b) pressure is increased and temperature is decreased
   c) both pressure and temperature are increased
   d) both pressure and temperature are decreased

52. Which of the following sequence is correct in terms of the polarity of bond
   a) N-F > C-F > B-F
   b) B-F > C-F > N-F
   c) C-F > N-F > B-F
   d) B-F = C-F > N-F

53. Which of the following does not happen during the Calvin cycle?
   a) Regeneration of the CO_2 acceptor
   b) Oxidation of NADPH
   c) Release of oxygen
   d) Consumption of ATP

54. Two solid cylinders 1 and 2 (mass $M_1 > M_2$ and radius $R_1 > R_2$) roll down from the rest on an inclined plane such that there is no loss of energy due to friction. Which of the spheres will reach at the bottom first
   a) cylinder 1
   b) cylinder 2
   c) cylinder with greater moment of inertia
   d) both will reach at same time

55. Immunity can be gained actively or passively. When the antibodies to antigens are produced by our own bodies, we call it active immunity. We acquire passive immunity by receiving antibodies that were not made by our own bodies. Which of the following options is the correct match of the type of immunity with the appropriate example.

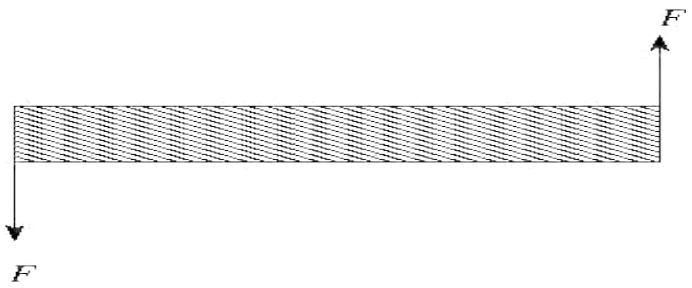
A)	Naturally acquired ACTIVE IMMUNITY	i)	Jasmine was vaccinated for Polio to protect her against the disease.
B)	Artificially acquired ACTIVE IMMUNITY	ii)	Rohit was bitten by a viper and was given injections of anti-venom.
C)	Naturally acquired PASSIVE IMMUNITY	iii)	Imran suffered from Chicken pox in childhood and is now possibly immune to another chicken pox attack.
D)	Artificially acquired PASSIVE IMMUNITY	iv)	Ria was advised by doctors to breast feed her new born in order to improve infant's immunity.

   a) A → i, B → iii, C → ii, D → iv
   b) A → iii, B → i, C → iv, D → ii
   c) A → i, B → iii, C → iv, D → ii
   d) A → iii, B → i, C → ii, D → iv

56. If HCl molecule is completely ionic the H^+ and Cl^- ions would bear a unit charge equal to 4.80×10^{-10} esu and the bond distance between H and Cl atom is 1.27 A° then the dipole moment of HCl is

a) 3.779 D
b) 7.742 D
c) 6.096 D
d) 2.976 D

57. A rod rests on a friction less surface. Two forces each of magnitude F are applied in the opposite direction on the edges of the rod as shown in the figure below. Which of the following quantities are non-zero and constant:
(i) angular momentum (ii) angular acceleration (iii) Total force (iv) total torque (v) total linear momentum (vi) total kinetic energy (vii) moment of inertia (viii) translation kinetic energy

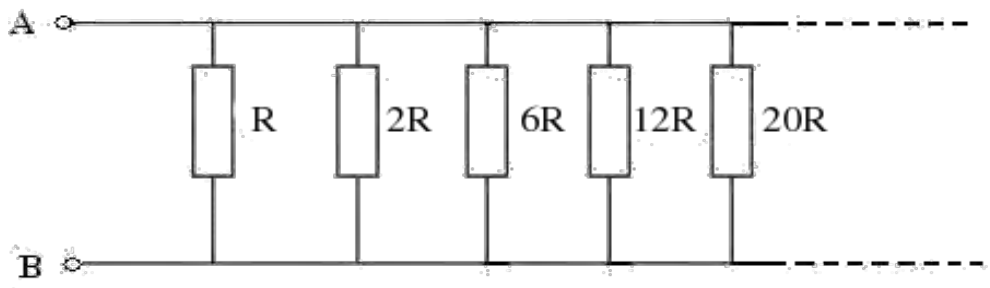


a) i, ii, iii,v, vi
b) ii, iv and vii
c) ii, iii, iv, vii,viii
d) i, iii, v,vi, viii

58. The pH of solution X is 2 and that of Y is 4. Which statement is correct about the hydrogen ion concentrations in the two solutions?

a) $[H^+]$ in X is half that in Y.
b) $[H^+]$ in X is twice that in Y.
c) $[H^+]$ in X is ten times of that in Y.
d) $[H^+]$ in X is hundred times that in Y.

59. In the figure given below what is the value of R between points A and B?



a) $\frac{2R}{3}$ b) R c) 0 d) $\frac{R}{2}$

60. The average molecular weight of a standard amino acid is 128 dalton. Assume that a scientist has synthesized a new protein molecule which is composed of 250 of these amino acids. Also, we know that molecular weight of a water molecule is 18. The best estimate of molecular weight of synthesized protein will be...

a) 32000 dalton
b) 27518 dalton
c) 27500 dalton
d) 27000 dalton

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)

61. Osmosis is the movement of water molecules from a region of their higher concentration (dilute solution) to a region of their lower concentration (concentrated solution) through a semi-permeable membrane. Water potential is the tendency of water molecules to move from one place to another through membranes. It is denoted by ψ and is measured in terms of the unit called "pascals".

Water potential of a plant cell is affected by 2 factors, viz; solute concentration ψ_s and the pressure generated when water enters and inflates a plant cell. When a solute is dissolved in pure water, concentration of water molecules reduces and hence water potential lowers down. The amount of this lowering is known as the solute potential. Thus solute potential is a measure of the change in water potential of a system due to the presence of solute molecules. If a pressure is applied to pure water or a solution, its water potential increases. This happens because the pressure is tending to force the water from one place to another. Thus we can say that pressure generated when water

enters or inflates the plant cell is pressure potential. It is denoted as ψ_p . Water potential is affected by both solute potential and pressure potential. The relationship between them is given as -

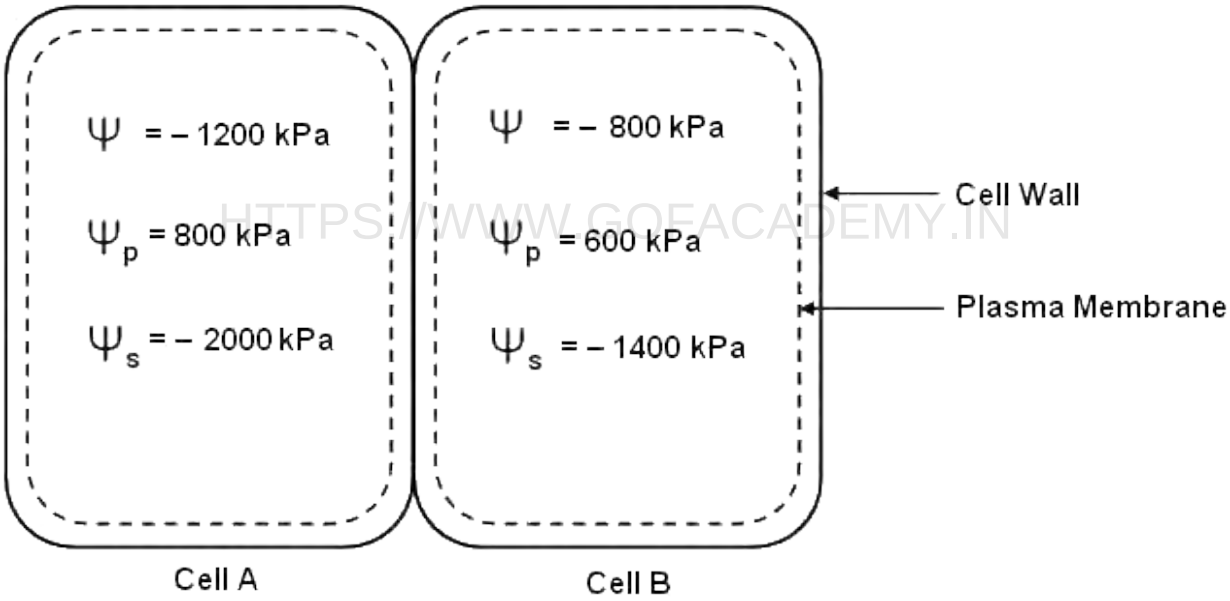
$$\psi = \psi_s + \psi_p$$

Using the above description, answer the following questions.

1. Which of the following statement is correct? (1 Mark)
(a) Pure water has maximum water potential which is always positive.
(b) Pure water has minimum water potential which is always negative.
(c) All solutions have higher water potentials than pure water and have positive values of ψ .
(d) All solutions have lower water potentials than pure water and have negative values of ψ .

2. What is ψ_p of a flaccid cell? (0.5 Mark)

3. Following are two neighboring plant cells in contact with each other.



A) Which cell has the higher water potential? (1 Mark)

B) In which direction will water move by osmosis? (1 Mark)

4. At equilibrium two cells will have the same water potential. What will be their water potential at equilibrium? (0.5 Mark)

5. Assuming that ψ_s does not change significantly, what would be ψ_p at equilibrium in Cell A and Cell B. (1 Mark)

62. a) Momentum of a ball is changed to $\sqrt{3}$ times its initial value by an application of a force causing it to deflect by 90°. Calculate the angle between the direction of force and the initial momentum.

(3 Marks)

b) In a specially designed device, force varies linearly from zero to a max. value of 10 N, over a distance of 8m. The force remains constant for next 4m and then reduces linearly to zero over another distance of 2m. Draw a F vs. x (distance) graph and hence calculate work done by the force over this distance of 2m. Use the attached graph sheet at the end of the answer booklet.

(2 Marks)

63. An atom consists of an extremely small and dense nucleus and an extranuclear space. The nucleus contains positively charged protons, neutral neutrons and these particles are collectively called nucleons. In the extranuclear space negatively charged electrons revolve around the nucleus. A region of space around the nucleus of the atom where the electron is most likely to be found is called an orbital. In an atom a large no. of electron orbitals are present. These orbitals are designated by a set of numbers known as quantum numbers. These quantum nos. describe electronic configuration, energy of an electron in the atom, size, shape and orientation of the electron orbital. An element has 2K, 8L, 13M and 1N electrons.

a) Identify the element and write its electronic configuration using Aufbau Principle. (1.5 Marks)
b) How many sub shells, orbitals and unpaired electrons it has? (1.5 Marks)
c) How many electrons have $l = 1$ and $l = 2$? (1 Mark)
d) How many electrons in d sub shell have m = 0 in the given element? (0.5 Mark)
e) How many orbitals are possible in 4th energy level of the given element? (0.5 Mark)

64. Find last digit of 1!+2!+3!+4!+.....+(95)!

(2 Marks)

65. A rise in the ocean level is expected on account of the melting of icebergs due to global warming. The iceberg R-15 broke off the Ross Ice-Shelf in Antarctica and plunged into the ocean in 2000. We estimate the rise in ocean level due to this event. The iceberg was made of fresh water and shaped as a cuboid of cross sectional area $A = 10000\ \text{km}^2$ and height $h = 0.4$ km. The total ocean surface area is $3.61 \times 10^8\ \text{km}^2$ and ocean water has density $\rho_o = 1024\ \text{kg}\cdot\text{m}^{-3}$.

i. What is the rise in the ocean level due to plunging of iceberg in the ocean?
ii. The iceberg R-15 subsequently melted. What is the additional rise or fall if any in the ocean level due to the melting? Ignore thermal expansion.
iii. Estimate the percentage of the earth surface which is covered by ocean water.

(5 Marks)

66. a) Prove that a square of a natural number leaves either 0 or 1 as remainder upon division by 4.

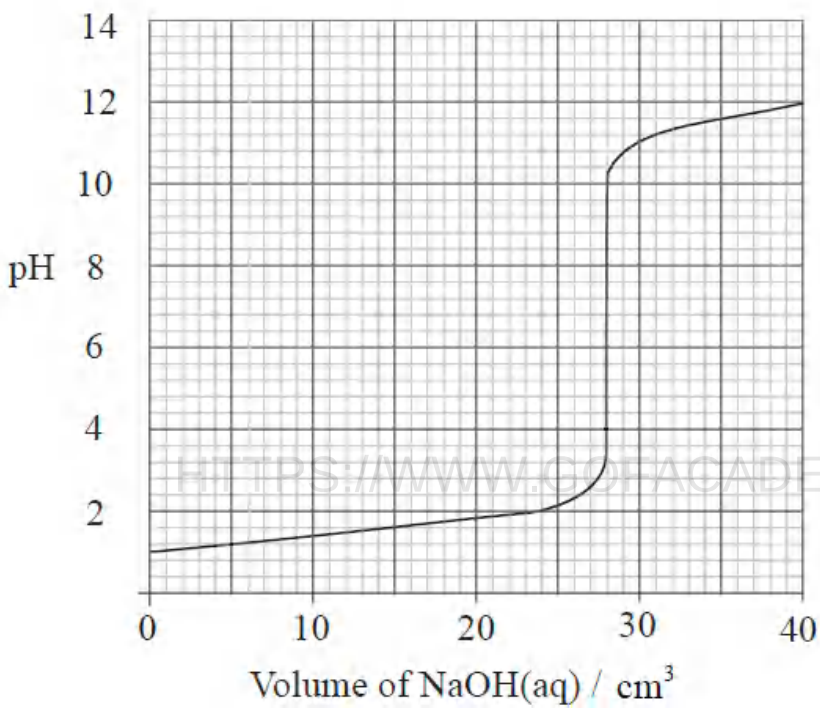
(3 marks)

b) Find, with proof, all positive integers n such that n! + 2 is the square of a natural number.

(5 Marks)

67. a) A titration was carried out to determine the concentration of 25.0 cm^3 of an aqueous solution of nitric acid. The pH value of the liquid in the flask was measured as 0.100 mol dm^{-3} of aqueous sodium hydroxide was added. The results are shown on the graph below.

(2 Marks)



(i) Use the graph to determine the volume of 0.100 mol dm^{-3} aqueous sodium hydroxide solution needed to exactly neutralize the nitric acid.

(ii) Determine the pH value when the value of $[H^+]$ has decreased to 1×10^{-3}mol dm^{-3}

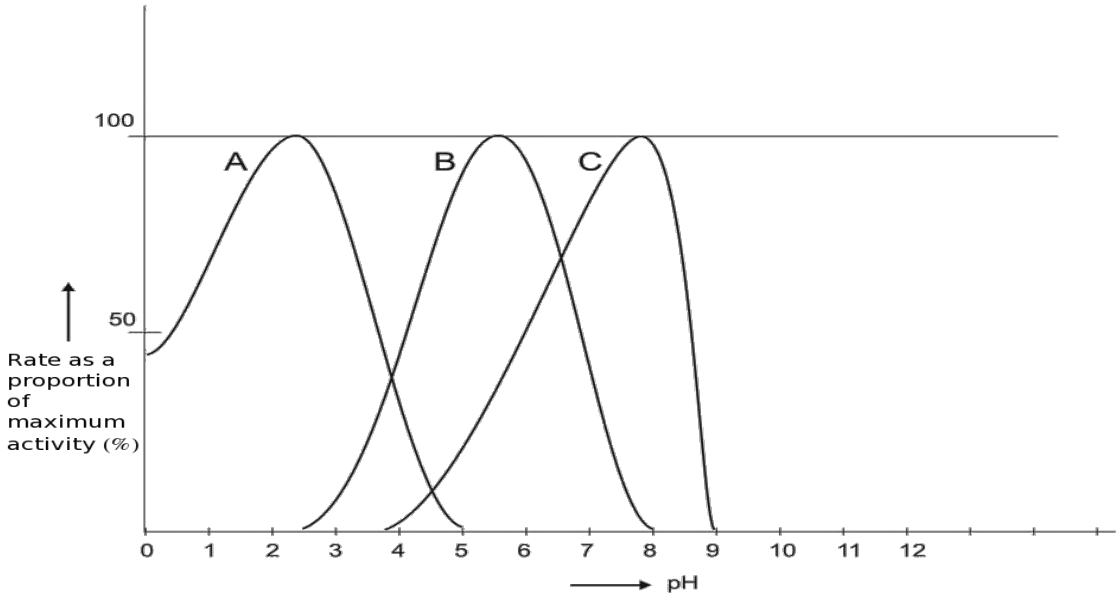
(iii) Use the graph to determine the value of $[H^+]$ of the nitric acid solution.

b) Mr. Robert asked Mr. Robin to carry out contact process for the production of oil of vitriol. It was a reaction which they carried out first time and they were not aware that large amount of heat will be released. They produced one mole of sulphur trioxide from sulphur and sulphur dioxide by oxidation individually. They found enthalpy change value for those reactions as 395 kJ and 98 kJ respectively. They decided to find out heat of formation of sulphur dioxide from those two oxidation reactions. Can you help them to calculate?

(3 Marks)

68. The graph shows the activity of three enzymes A,B and C at different pH values. Study the given graph and answer the following.

(5 Marks)



1. What is the optimum pH for the activity of enzyme B?

2. Name the enzymes from the following list of enzymes which could represent-
a) activity curve A
b) activity curve B

Enzymes: Chymotrypsin, Pepsin, Sucrase, Salivary amylase, Pancreatic lipase, Catalase.

3. What could be the reason for decrease in the activity of enzyme C for the pH between 8 and 9?

4. 1 cm^3 of catalase solution was added to hydrogen peroxide solution at different pH values and the time taken to collect 10 cm^3 of oxygen was measured. The results are given below. Plot a graph using the given data on the graph sheet attached at the end of the answer booklet.

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

5. What is the optimum pH for catalase activity?

6. Explain what happens to ionisable groups of the active site from pH 4 to 6 and pH 6 to 8?

Space for Rough Work

Space for Rough Work

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

Q.No.	Ans.
1	a
2	b
3	d
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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.

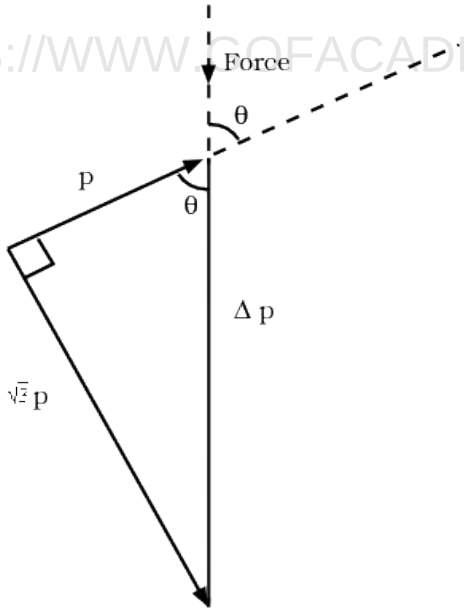
61. 1. (d) All solutions have lower water potentials than pure water and have negative values of ψ .

2. ψ_p of a flaccid cell is zero.

3. A) Cell B
B) Cell B to Cell A
4. ψ = -1000 kPa
5. ψ_p at equilibrium

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

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

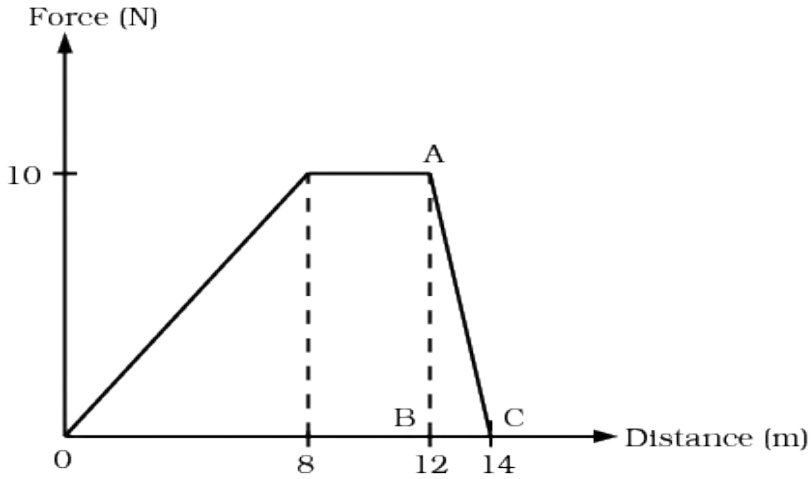


As per the momentum diagram,
using Newton's second law,
Force acts in direction of change in momentum Δp

$\therefore \tan\theta = \dfrac{\sqrt{3}\,p}{p} = \sqrt{3}$

$\therefore \theta = 60°$

b)



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

$= \frac{1}{2} \times 2 \times 10$

$= 10$ 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) $\rho_i = 917 \ \text{kg·m}^{-3}$

$\rho_w = 1000 \ \text{kg·m}^{-3}$

$\rho_o = 1024 \ \text{kg·m}^{-3}$

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.

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

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

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

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

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.

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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) $[HNO_3] = 2.80 \times 10 - 3 \div 0.025$
$= 0.112 \text{ mol dm}^{-3}$

b)

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

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

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

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2. a) Activity curve A – Pepsin (2.00)
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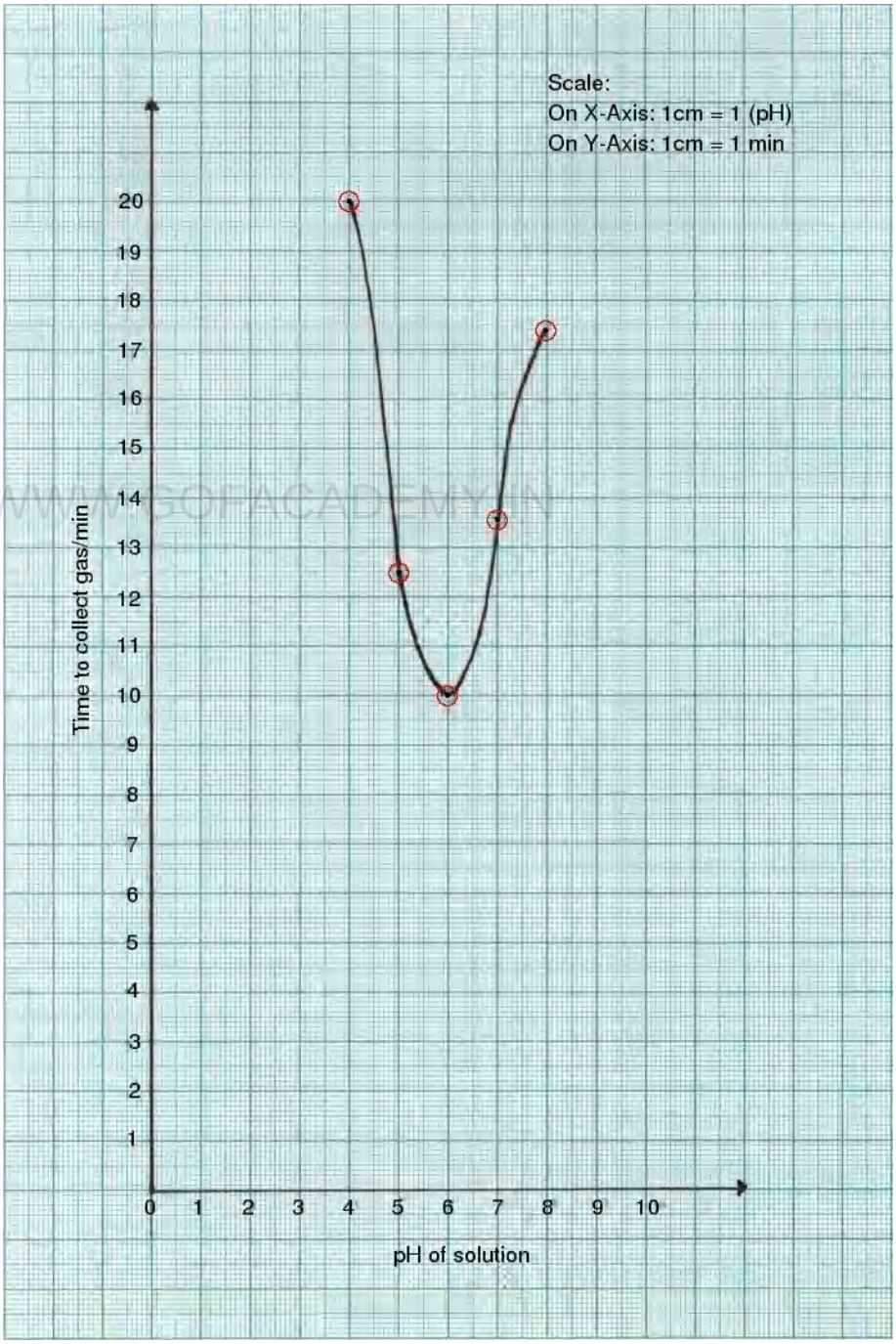

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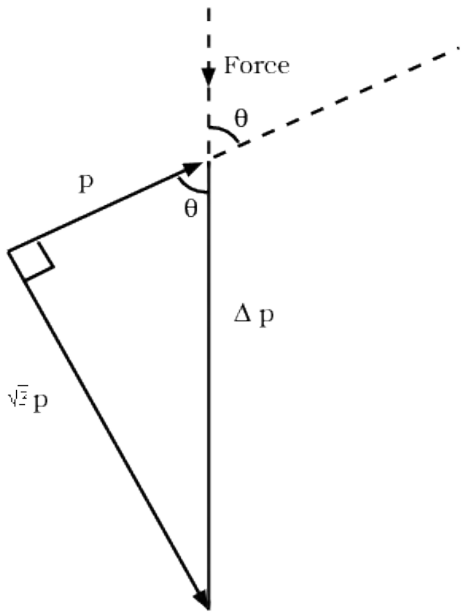

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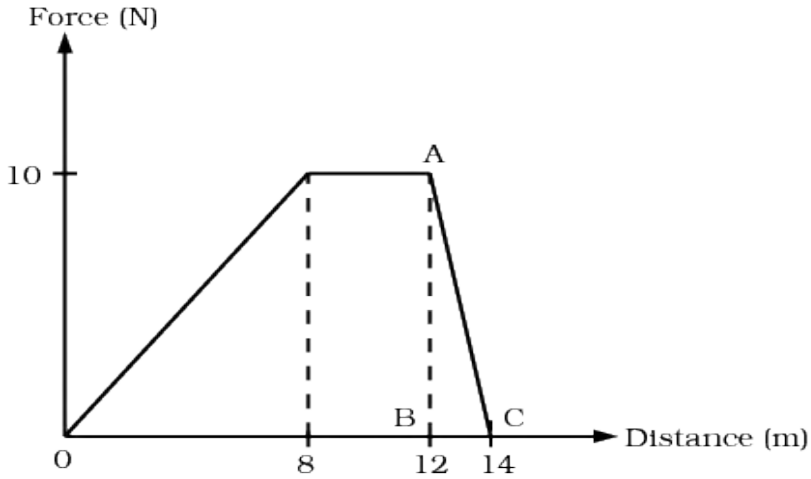

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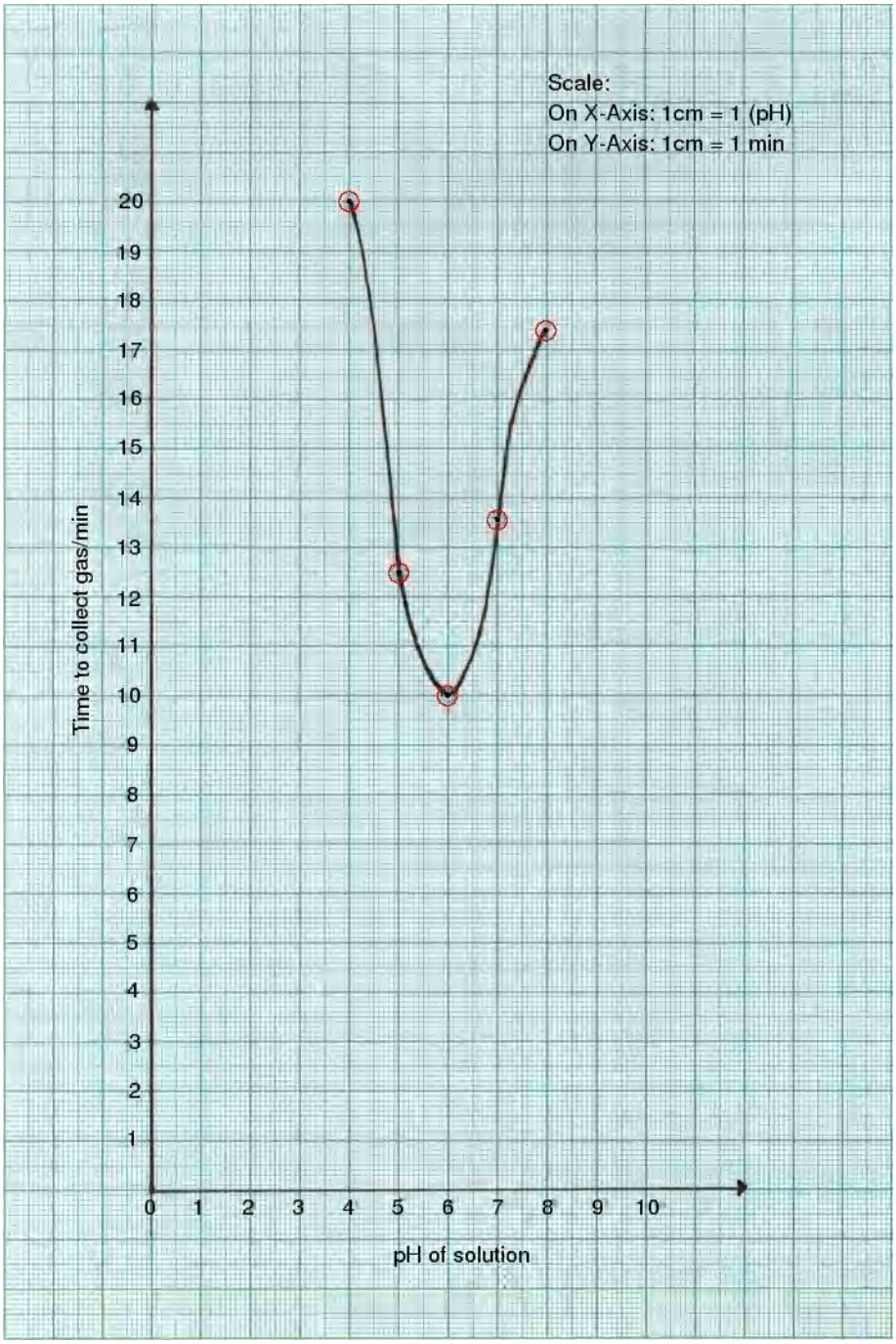

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