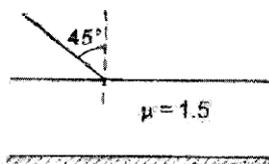


## YEAR-2013-14\_NSEJS(STAGE-I)

1. One side of a glass slab is silvered as shown in the figure. A ray of light is incident on the other side at angle of incidence  $i=45^\circ$ . Refractive index of glass is given as 1.5. The deviation of the ray of light from its initial path when it comes out of the slab is (Given  $\sin^{-1} \frac{\sqrt{2}}{3} = 28^\circ$ )

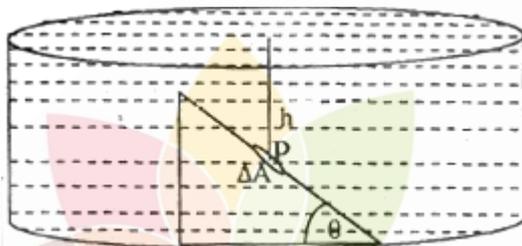


- (A)  $90^\circ$                       (B)  $180^\circ$                       (C)  $120^\circ$                       (D)  $45^\circ$
2. The number  $5\sqrt{41}$  lies between  
 (A) 29 and 30                      (B) 30 and 31                      (c) 31 and 32                      (D) 32 and 33
3. Oxidation number and co-ordination number of Pt in cisplatin  $\text{PtCl}_2(\text{NH}_3)_2$  are respectively  
 (A) +4 and 2                      (B) +2 and 4                      (C) 0 and 4                      (D) +2 and 6

**Passage for Q(4–6) :** In a field one summer's day a Grasshopper was hopping about, chirping and singing to its heart's content. An Ant passed by, bearing along with great toil an ear of pea he was taking to the nest. "Why not come and chat with me," said the Grasshopper, "instead of to toiling and moling in that way?" "I am helping to lay up food for the winter," said the Ant, "and recommend you to do the same." "Why bother about winter?" said the Grasshopper; "We have got plenty of food at present." But the Ant went on its way and continued its toil. When the winter came the Grasshopper had no food and found itself dying of hunger - while it saw the ants distributing every day corn and grain from the stores they had collected in the summer. Then the Grasshopper knew: It is best to prepare for days of need

4. In the passage given above there seems to be a factual error with respect to the ant carrying the food to the nest. The most probable reason for this mistake would be  
 a) Pea pod is too heavy for an ant to carry to its nest.  
 b) Pea cannot be carried by an ant in the summer because it is a Rabi crop.  
 c) Ant couldn't have passed by easily since it is the favourite food of grasshoppers.  
 d) Grasshoppers avoid coming out in summer and thus there cannot be grasshopper in the story.
5. What could be the most plausible reason that all the ants that toiled and milled in the summer were happy and content in the winter?  
 a) Ants were probably happy since their food was not shared with Grasshopper.  
 b) Ants need not worry to work anymore since they had food stocked.  
 c) Ants were happy since they enjoyed working together in summer.  
 d) Food that was procured was efficiently distributed and managed so that all the ants were fed equally.
6. Grasshopper was at fault in this story mostly because  
 a) Of its attitude towards ants who were working tirelessly.  
 b) Of not having a forethought to store food for the upcoming winter season.  
 c) Of chirping and singing to its heart's content in the summer.  
 d) It should have asked ants for the food and managed to surpass the winter somehow.

7. An object of mass 1 kg is made to slide down a smooth inclined plane of length 20m. If the kinetic energy possessed by the body at the bottom of the plane is 100 J, then the inclination of the plane with the horizontal is (take  $g = 10 \text{ ms}^{-2}$ )
- (a)  $45^\circ$  (B)  $37^\circ$  (C)  $60^\circ$  (D)  $30^\circ$
8. Two circles each of radius 3 touch each other externally in the plane. In how many ways can a circle of radius 8 be placed in the plane touching each of these two circles ?
- (A) 2 (B) 4 (C) 6 (D) 8
9. Which of these elements has the greatest electronegativity ?
- (A) Br (B) N (C) O (D) S
10. An inclined plane of inclination  $\theta$  is placed in water as shown in figure given below. Consider a small area ( $\Delta A$ ) around point P at a depth h. If Density of water is  $\rho$  and acceleration due to gravity is g the force experienced by  $\Delta A$  due to hydrostatic pressure is



- (A)  $\rho gh(\Delta A)$  (B)  $\rho gh(\Delta A) \sin\theta$  (C)  $\rho gh(\square\Delta A)$  (D)  $\rho gh(\Delta A) \sec\theta$
11. If  $3x + 3y - 1$ ,  $4x^2 + y - 5$ ,  $4x + 2y$  are the sides of an equilateral triangle, its area is closest to the integer
- (A) 84 (B) 85 (C) 86 (D) 87
12. The pH of a 0.025 M solution of KOH is
- (A) 1.60 (B) 3.69 (C) 10.31 (D) 12.40
13. Consider the following two statements about light & sound. Choose the most appropriate option
- (i) When light and sound travel air to water, light may bend towards normal while sound may bend away from normal.
- (ii) Sound is longitudinal wave while light is transverse wave.
- a) Statement (i) is correct while statement (ii) is incorrect
- b) Statement (i) and statement (ii) are both correct and statement (ii) is not the reason for statement (i)
- c) Statement (i) and statement (ii) are incorrect
- d) Statement (i) and statement (ii) are correct and Statement (ii) is the correct reason for statement (i)

14. If  $xy^2 = a^2$ ,  $yz^2 = b^3$  and  $zx^2 = c^3$  then  $z^3$  equals

(a)  $\frac{bc^4}{a^2}$

(b)  $\frac{b^4c}{a^2}$

(c)  $\frac{b^2c^4}{b^2}$

(d)  $\frac{ab^4}{c^2}$

15. How many H atoms are in 3.4 g of  $C_{12}H_{22}O_{11}$  ?

(a)  $6.0 \times 10^{23}$

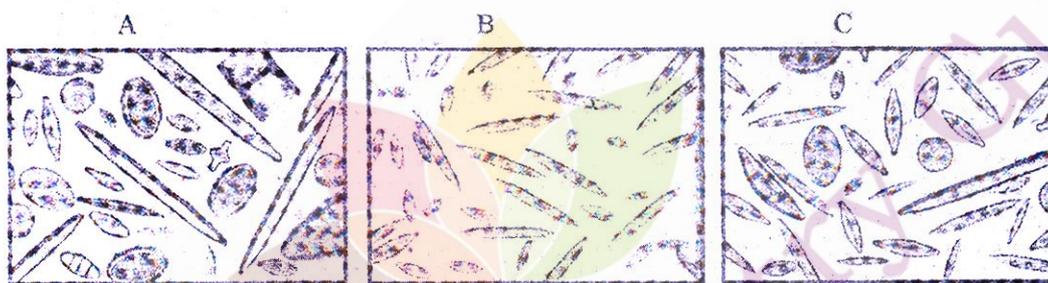
(b)  $1.3 \times 10^{23}$

(c)  $3.8 \times 10^{22}$

(d)  $6.0 \times 10^{21}$

**Passage Q(16-18) :** Diatoms are the most common photosynthetic aquatic microorganisms group of algae which are unicellular and can exist as colonies in the shape of filaments or ribbons, fans, zigzags or stars depending on the quality of the water. Diatom communities are a popular tool for studies of water quality and pollution management. Karthik from Bangalore recently went on a field trip from Bangalore to Mysore. On the way he stopped his car at a sewage canal, a lake and a mountain stream and collected water samples from all the these places for his lab work. After a careful analysis of his water samples. he observed that diatoms came with varying size/shape and the size/shape increases has (have?) something to do with the water quality.

16. Below are the diatoms observed under a microscope by Karthik. Help him to recognise the correct order of sample localities (Viz., Canal, Stram and lake).



- a) A - Mountain stream, B - Sewage Canal, C - Lake  
b) A - Sewage Canal, B - Lake, C - Mountain Stream  
c) A - Lake, B - Mountain stream, C - Sewage Canal  
d) A - Mountain stream, B - Lake, C - Sewage canal

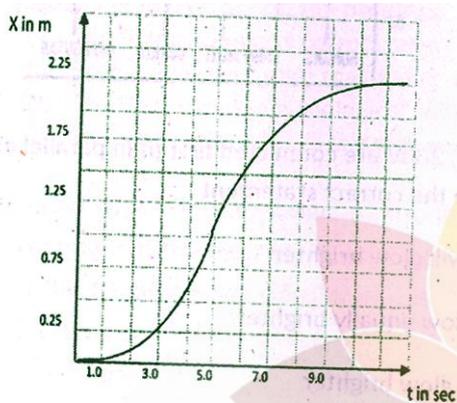
17. What is the take home message from the above experiment

- a) Diatoms come in different sizes and shapes  
b) The difference in size and shapes from different water samples, is suggestive of the intensity of water pollution.  
c) Karthik enjoyed collecting samples from different locations,  
d) Nothing can be inferred from the above experiment.

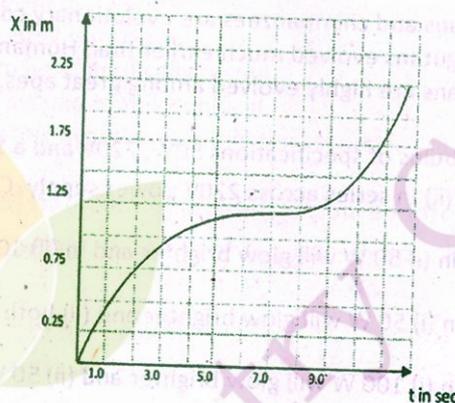
18. In the above experiment, difference in sizes and shapes of diatoms should be inferred as

- a) Different species of diatoms  
b) Different genera of diatoms.  
c) Different families of diatoms.  
d) Different orders of diatoms.

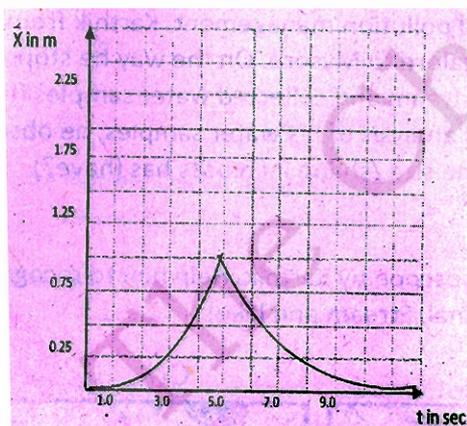
19. The percentage change in acceleration due to gravity at an altitude equal to radius of earth compared to that on the surface of earth is given by
- a) 25% increase      b) 35% decrease      c) 75% decrease      d) 25% decrease
20. Let  $a, b$  be two positive real numbers such that  $a < b < \frac{1}{a}$  and let  $x = \left(a + \frac{1}{a}\right) - \left(b + \frac{1}{b}\right)$ . Then
- a)  $x$  is always greater than zero      b)  $x$  is always less than zero  
 c)  $x = 0$       d) No such definite conclusion can be drawn about  $x$
21. Which of the following species has standard enthalpy of formation as  $0 \text{ kJ mol}^{-1}$ ?
- a)  $\text{H}_2\text{O}_{(l)}$       b)  $\text{Na}_{(g)}$       (C)  $\text{Na}_{(s)}$       (D)  $\text{CO}_{2(g)}$
22. A particle accelerates with a constant acceleration  $a_0$  and reaches a maximum velocity and then decelerates with  $a_0$  and comes to rest. The position time graph describing the situation is best represented by



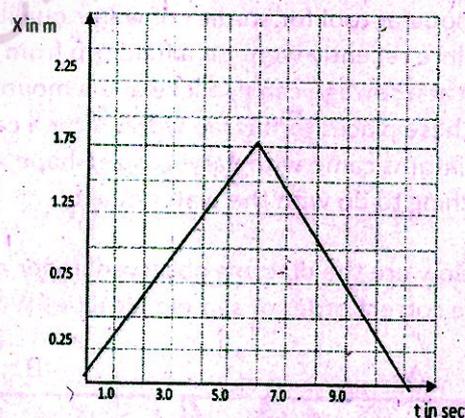
(a)



(b)



(c)



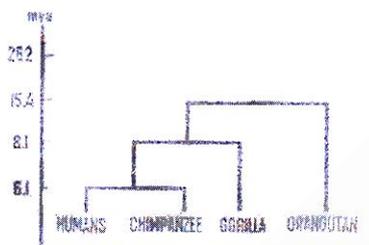
(d)

23. Let  $m$  be the number of distinct (non congruent) integer-sided triangles each with perimeter 15 and  $n$  be the number of distinct (non congruent) integer sided triangles each with perimeter 16.  
Then  $m - n$  equals  
a)  $-2$                       b)  $0$                       c)  $2$                       d)  $-4$
24. What is the molality of a solution made by dissolving 100 g of bromothymol blue ( $C_{27}H_{28}Br_2O_5S$ ) in 1.00 L of ethanol on a winter's day at  $10^\circ C$  ? The density of ethanol at this temperature is  $0.7979 \text{ kg L}^{-1}$   
a)  $0.100 \text{ mol kg}^{-1}$       b)  $0.128 \text{ mol kg}^{-1}$       c)  $0.160 \text{ mol kg}^{-1}$       d)  $0.201 \text{ mol kg}^{-1}$
25. Two bulbs of specifications 50W, 220 V and a 100W, 200V are connected first (i) in parallel and then (ii) in series across 220 V power supply. Choose the correct statement  
a) In (i) 50 W will glow brighter and in (ii) 100 W will glow brighter  
b) In (i) 50 W will glow brighter and (ii) both will glow equally brighter.  
c) In (i) 100 W will glow brighter and (ii) 50 W will glow brighter  
d) In both cases the 50 W bulb will glow brighter.
26. Let  $T$  be the number of 4-digit integers, each ending in 3 (in units place) and each divisible by 11. Then  
a)  $20 \leq T \leq 79$       b)  $80 \leq T \leq 89$       c)  $90 \leq T \leq 99$       d)  $T \geq 100$
27. 1.000 mL of  $0.1000 \text{ mol L}^{-1}$  hydrochloric acid was diluted to 100.0 mL with deionised water. 10.00 mL of this solution was diluted to 100.0 mL again using deionised water. What is the pH of the final solution ?  
a) 2                      b) 3                      c) 4                      d) 5
28. While playing football, Dimple fell down and was badly wounded on her left. The Doctor prescribed her antibiotics for a week which should have healed her of the wound in a week. However, Dimple's wound did not heal in a week. What among the following could have been the reason for inability of the wound to heal in the prescribed time frame given by the doctor ?  
a) Prescribed medicine's date was expired.  
b) Dimple wouldn't have taken the full course of the antibiotics.  
c) Both a & b could be the reason  
d) Doctor's inability to prescribe the correct medicine for the wound.
29. Which of the following situation is impossible ?  
a) A body having velocity and acceleration in opposite directions.  
b) A body having zero velocity and non zero acceleration  
c) A body having constant acceleration and variable velocity  
d) A body having constant velocity and variable acceleration.
30. At what time (to the nearest second) immediately after 4 O' clock will angle between the hands of the clock be the same as that at 4 O' clock ?  
a)  $4^h 42^m 50^s$       b)  $4^h 43^m 38^s$       c)  $4^h 43^m 40^s$       d)  $5^h 5^m 27^s$

31. 0.5755 g of a compound, containing sulfur and fluorine only, has a volume of 255.0 mL at 288.0 K and 50.01 kPa. What is the molecular formula of this compound ?

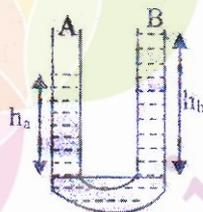
- a)  $S_2F_2$                       b)  $SF_2$                       c)  $SF_4$                       d)  $SF_6$

32. Given here is a phylogenetic tree (family tree) of greater apes. Which of the following statements cannot be true from the tree ? (mya-million years ago)



- a) Humans did not evolve from chimpanzees.  
 b) Humans and chimpanzees are evolutionary cousins.  
 c) Orangutans evolved much earlier than Humans.  
 d) Humans are highly evolved among great apes.

33. A liquid (A) of density  $1.6 \text{ g cm}^{-3}$  and liquid (B) of unknown density is poured into a U-tube as shown in the figure. The liquids are immiscible. If height of A is  $h_A = 26.6 \text{ cm}$  and height of B is  $h_B = 50 \text{ cm}$  the density of B is



- a)  $0.85 \text{ g cm}^{-3}$                       b)  $3.01 \text{ g cm}^{-3}$                       c)  $0.33 \text{ g cm}^{-3}$                       d)  $1.18 \text{ g cm}^{-3}$

34. If a and b are two positive real numbers such that  $\frac{a^2 + b^2}{ab} = 6$ , then a positive value of  $\frac{a}{b}$  lies between

- a) 2 and 3                      b) 3 and 4                      c) 4 and 5                      d) 5 and 6

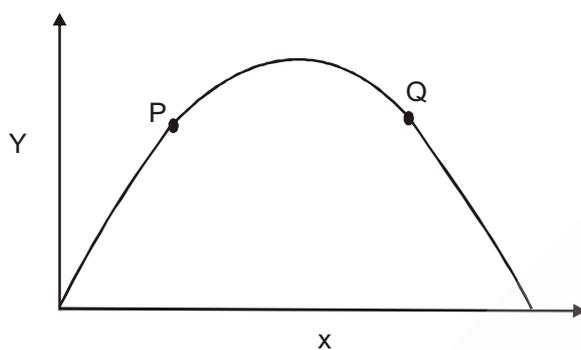
35. The isomerism which exists between  $\text{CH}_3\text{CHCl}_2$  and  $\text{CH}_2\text{ClCH}_2\text{Cl}$  is

- a) chain isomerism                      b) functional group isomerism  
 c) positional isomerism                      d) metamerism

36. The term Biodiversity refers to

- a) Species Diversity                      b) Genetic diversity  
 c) Ecosystem diversity                      d) All of the above

37. Diagram shows trajectory of a cricket ball. The set of arrows which show the direction of the acceleration of ball at points P and Q respectively is



38. Sucharitha purchases  $x$  pencils at Rs  $x$  each,  $y$  pens at Rs  $y$  each and  $z$  notebooks at Rs  $z$  each. She purchases altogether 50 items and pays Rs. 1000. The cost of  $y$  pencils,  $z$  pens and  $x$  notebooks is
- a) Rs 600                      b) Rs.750                      c) Rs.500                      d) Rs.350
39. The metal that does not give  $H_2$  on treatment with dilute HCl is
- a) Zn                              b) Fe                              c) Ag                              d) Ca
40. On a field trip in North America, students noticed that when threatened, Horned lizards (Genus : phrynosoma) squirt blood at the attackers. When the professor asked what could have been the reason behind such behaviour of Horned lizards, one student said that certain sensory receptors had fired and triggered a neuronal reflex culminating in increasing the pressure in their sinus cavities until the blood vessels in the corners of the eyes burst. Another student said that it was just an act to frighten off the predator. Thus it can be said that
- a) The first response is correct, while the second is incorrect
- b) Both explanations are reasonable and can be scientifically tested.
- c) The first response is biological, while the second is philosophical.
- d) The first explanation is testable as a scientific hypothesis, while the second is not.
41. If temperature of a certain mass of aluminum having specific heat capacity of  $0.8 \text{ J/g}^\circ\text{C}$  is lowered by  $6^\circ\text{C}$  and heat lost is 96J, then mass of aluminum is
- a) 16g                              b) 48g                              c) 60g                              d) 20g
42. The number of real values of  $a$  for which the cubic equation  $x^3 - 3ax^2 + 3ax - a = 0$  has all real roots, one of which is a itself, is
- a) 0                                  b) 1                                  c) 2                                  d) 3
43. The maximum number of isomers for an alkene with molecular formula  $C_4H_8$  is
- a) 5                                  b) 4                                  c) 2                                  d) 3

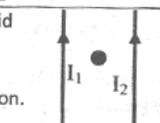
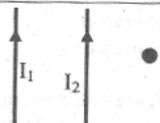
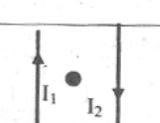
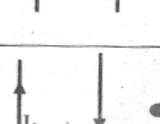


52. In pregnant women, foetus's physiological functions like nourishment, respiration and excretion are taken up by  
a) Stomach of mother    b) Placenta    c) Umbilical cord    d) Uterus
53. On a rainy wet day, a thunder is heard 6 second after lightening. If speed of sound is  $350 \text{ ms}^{-1}$  the altitude of the clouds is  
a) 1.8 km    b) 1.9 km    c) 2.1 km    d) 2.5 km
54. A certain principal becomes Rs. 96800 in 2 years if compounded annually at a certain rate of interest. The same principal becomes Rs. 97240 in two years if compounded half yearly at the same rate of interest. The rate of interest is  
a) 8%    b)  $8\frac{1}{3}$     c) 10%    d)  $12\frac{1}{2}$  %
55. Which properties of plastics make their disposal difficult : (I) PVC produces harmful combustion products ; (II) polyalkenes are highly flammable ; (III) polyalkenes are non-biodegradable  
a) I and II only    b) I and III only    c) II and III only    d) I, II, III
56. Suresh accidentally touched silencer of his two wheeler while parking and withdrew his leg Immediately. Identify the correct order of the flow of message to the brain ?  
a) Receptor → Sensory neuron → CNS → Motor neuron → Effectors  
b) Sensory neuron → CNS → Motor neuron → Effectors → REceptors  
c) CNS → Motor neuron → Effectors → Receptors → Sensory neuron  
d) Effectors → Receptors → Sensory neuron → Motor neuron
57. There three bodies A, B and C. Body A when brought closer to B, attract. When body B is brought closer to C they repel. We can then conclude  
a) Body A and B should have opposite charges while Body C should have the same charge as B  
b) Body B and C should have same kind of charge while Body A may have opposite charge.  
c) Body A and B should have same charge while Body C may have opposite charge.  
d) Body C is nuetral while Body A dn B should have opposite charge.
58. A pen costs Rs 13 and a note book costs Rs. 35 Let m be the maximum number of items that can be bought for Rs 1000 and n be the minimum number of items that can be bought for the same amount. Then m + n is  
a) 76    b) 88    c) 96    d) 98
59. When the pH of the environment of a protein is changed, it is said to be denatured. This is due to :  
a) breakage of peptide bonds    b) breakage of disulfide links  
c) loss of tertiary structure    d) breakdown of R groups

60. If Brain is controlling unit of an organism, then at cellular level which cell organelle can be comparable to Brain ?
- a) Chloroplast                      b) Ribosome                      c) Nucleus                      d) Lysosome
61. Aldebaron, the brightest star in the constellation Taurus rises at local time 7:00 pm of 1<sup>st</sup> of October. On November 1<sup>st</sup> the star will rise at
- a) 5:00 pm                      b) 6:00 pm                      c) 9:00 pm                      d) 8:34 pm
62. In the xy-plane let A be the point (5,0) and L be the line  $y = \frac{x}{3}$ . The number of points P on the line L such that triangle OAP is isosceles is (O being the origin)
- a) 2                      b) 3                      c) 4                      d) 5
63. For the reaction,  $2A + B \rightarrow C$  which relationship is correct ?
- a)  $\Delta[A] = \Delta[C]$                       b)  $-\Delta[A] = \Delta[C]$                       c)  $-2\Delta[A] = \Delta[C]$                       d)  $-\Delta[A] = 2\Delta[C]$
64. In some societies, "Women were solely held responsible for giving birth to female baby" assuming no role for men. But scientific advancement has proved men equally responsible for the birth of either sex. Armed with this information which of the following would be the most appropriate scenario for the birth of female child ?
- a) Ovum with X chromosome and Sperm with Y chromosome is FEMALE  
 b) Ovum with Y chromosome and Sperm with Y chromosome is MALE  
 c) Ovum with x chromosome and Sperm with X  
 d) Ovum with X chromosome and Sperm without chromosome is FEMALE
65. A block of mass 2 Kg placed on a floor experiences an external force in horizontal direction of 20N, frictional force of 6N and normal force of 20N. The body travels a distance of 10m under the combined effect of all these force. If Initially body is at rest then what is the kinetic energy of the body at the end of 4m
- a) 140J                      b) 260 J                      c) 56 J                      d) 460 J
66. If  $x^3 = a + 1$  and  $x + (b/x) = a$  ; then x equals
- a)  $\frac{a(b+1)}{a^2-b}$                       b)  $\frac{ab+1}{a^2-b}$                       c)  $\frac{ab+a+1}{a^2-b}$                       d)  $\frac{ab-a-1}{a^2-b}$
67. An electrochemical cell constructed for the reaction :  $\text{Cu}^{2+}_{(aq)} + \text{M}_{(s)} \rightarrow \text{Cu}_{(s)} + \text{M}^{2+}_{(aq)}$  has an  $E^0 = 0.75 \text{ V}$ . The standard reduction potential for  $\text{Cu}^{2+}_{(aq)}$  is 0.34 V. What is the standard reduction potential for  $\text{M}^{2+}_{(aq)}$  ?
- a) 1.09V                      b) 0.410 V                      c) -0.410 V                      d) -1.09V
68. Which one of the following is said to produce seeds exposed and they are called naked seed plant
- a) Deodar & Pinus                      b) Marsilea & Nostoc  
 c) Maize & Garden Pea Plant                      d) Spirogyra & Funaria

69. A body of mass 2 kg moving in the positive X-direction with a speed  $4\text{ms}^{-1}$  collides head on with another body of mass 3 kg moving in the negative X-direction with a speed of  $1\text{ms}^{-1}$ . During collision a loud sound is heard and they both start moving together. The sound energy cannot be greater than n
- a) 12J                      b) 14J                      c) 15J                      d) 17.5J
70. Let a, b, c be positive real numbers such that  $abc \neq 1$ ,  $(ab)^2 = (bc)^4 = (ca)^x = abc$ . Then x equals
- a) 1                      b) 2                      c) 3                      d) 4/5
71. Which radiation is the easiest to shield ?
- a) alpha                      b) beta                      c) gamma                      d) neutron
72. Identify the correct order of sequence from exterior to interior.
- a) Cell → Nucleus → Chromosome → DNA → Protein  
 b) Nucleus → Cell → Chromosome → DNA → Protein  
 c) Cell → Nucleus → DNA → Chromosomes → Protein  
 d) Cell → Nucleus → Protein → DNA → Chromosome
73. In nuclear reactor, the electrons and protons are moving in opposite direction across a small hole in 2 second. If number of electron and protons are  $2 \times 10^{16}$  each, the current through the hole is given by
- a) 1.6mA                      b) 0mA                      c) 6.4mA                      d) 3.2mA
74. The sum  $1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \frac{1}{5} - \frac{1}{6} + \dots - \frac{1}{2012} + \frac{1}{2013}$  equals
- a)  $\frac{1}{1006} + \frac{1}{1007} + \frac{1}{1008} + \dots + \frac{1}{2013}$       b)  $\frac{1}{1007} + \frac{1}{1008} + \frac{1}{1009} + \dots + \frac{1}{2013}$   
 c)  $\frac{1}{1006} + \frac{1}{1007} + \frac{1}{1008} + \dots + \frac{1}{2012}$       d)  $\frac{1}{1007} + \frac{1}{1008} + \frac{1}{1009} + \dots + \frac{1}{2012}$
75. Which species below has the same general shape as  $\text{NH}_3$  ?
- a)  $\text{SO}_3^{2-}$                       b)  $\text{CO}_3^{2-}$                       c)  $\text{NO}_3^-$                       d)  $\text{SO}_3$
76. After hearing to an influential lecture on "how to conserve environment by avoiding usage of plastic"? Ghan Shyam resolved that he should also contribute towards protecting the environment from plastic menace. Can you suggest him the first step how should he go about doing this effectively
- a) He should urge his parents to stop using plastic materials at home.  
 b) He should write a letter to the local civic body against selling plastic materials around his locality.  
 c) He should practice minimising plastic usage himself.  
 d) He should ask his teacher to advice people on his behalf to stop usage of plastics.

77. Two infinite wires are placed parallel to each other. They carry current  $I_1$  and  $I_2$  ( $I_2 = I_1$ ). The magnetic field is  $B_1$  and  $B_2$  respectively. Different situations are given in column 1. The comments on the direction and strength of magnetic field are given in column II. Match the following.

Column 1	Column 2
1) The point $P$ is at the mid point of the two conductors carrying current in same direction. 	P) $B_2 > B_1$ ; Thus $B_2 + B_1$ getting into the plane of the paper.
2) The point $P$ is on right side of second conductor carrying current in same direction. 	Q) $B_2 > B_1$ ; $B_2 - B_1$ coming out of the plane of the paper.
3) The point $P$ is at the mid point of the two conductors carrying current in opposite direction. 	R) $B_1 = -B_2$ ; $B_2 - B_1 = 0$
4) The point $P$ is at the right of the two conductors carrying current in opposite direction. 	S) $B_1 = B_2$ ; Thus $B_1 + B_2 = 2B$ getting into the plane of paper

a) 

1	P
2	Q
3	R
4	S

b) 

1	R
2	P
3	S
4	Q

c) 

1	S
2	R
3	P
4	Q

d) 

1	S
2	R
3	Q
4	P

78. If the radius of the base of a cone is doubled then the slant area becomes 3 times the original slant area. Suppose when the radius of the base of the cone is quadrupled (that is increased to 4 times), the slant area becomes  $k$  times the original slant area. Then the integer closest to  $k$  is
- a) 6                      b) 8                      c) 10                      d) 11
79. The mass of 0.2 mole of Oxygen molecule is
- a) 6.4g                      b) 3.2g                      c) 1.6g                      d) 2.75g
80. Wuchereria is an example of :
- a) Arthropods                      b) Annelida                      c) Arthropoda                      d) Nematoda