

Indian Association of Physics Teachers

NATIONAL STANDARD EXAMINATION IN JUNIOR SCIENCE 2013-2014

Date of Examination 24th November 2013

Time: 15.00 to 17.00 Hrs

Question paper code	5 Five	1 One	4 Four
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Please read the instruction carefully before answering

INSTRUCTIONS TO CANDIDATES

1. On the answer sheet, fill up all the entries carefully in the space provided, **ONLY IN BLOCK CAPITALS**. Use only **BLUE** or **BLACK BALL PEN** for making entries and marking answers. Incomplete / incorrect / carelessly filled information may disqualify your candidature.
2. Write the Q. P. Code No. mentioned above on YOUR answer sheet (in the space provided). Otherwise your answer sheet will NOT be valued..
3. The question paper has 80 multiple choice questions. Each question has 4 options, out of which only one is correct. Choose the correct answer and shade the oval in the corresponding box on the answer sheet as shown below:

Correct Method



4. A correct answer carries 3 marks and 1 mark will be deducted for each wrong answers.
5. All rough work may be done on the blank sheet provided at the end of the question paper.
6. **PLEASE DO NOT MAKE ANY MARKS OTHER THAN SHADING IN THE SPACE PROVIDED ON THE ANSWER SHEET.** Answer sheets are evaluated with the help of a machine. Due to this, **CHANGE OF ENTRY IS NOT ALLOWED.**
7. Scratching or overwriting may result in wrong score. **DO NOT WRITE ANYTHING ON THE BACK OF ANSWER SHEET.**
8. Use of a nonprogrammable calculator is allowed.
9. **The answers / solutions to this question paper will be available on our website - www.iapt.org.in by 30th November 2013.**

CERTIFICATES & AWARDS

- i) Certificates to top 10% students of each centre.
- ii) Merit certificates to statewise Top 1% students.
- iii) Merit certificate to Nationwide Top 1% students.
10. **Result sheets** and the **“centre top 10%”** certificates of NSEJS are dispatched to the Professor in charge of the centre. You will get your marks from the Professor in charge of your centre by January 2014 end.
11. 300 (or so) students are selected for the next examination - Indian National Junior Science Olympiads (INJSO). Individual letters are sent to these students **ONLY**.
12. No queries will be entertained in this regard.

Indian Association of Physics Teachers

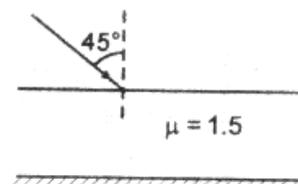
NATIONAL STANDARD EXAMINATION IN JUNIOR SCIENCE 2013-2014

Total time: 120 minutes

Marks: 240

Only one out of four options is correct

- 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 $\sin^{-1} \frac{\sqrt{2}}{3} = 28^\circ$)

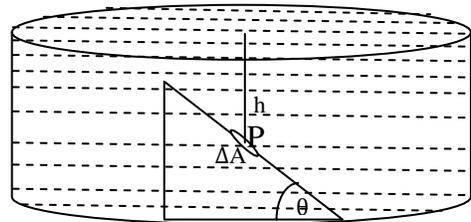


- (a) 90° (b) 180° (c) 120° (d) 45°
- 2) The number $5\sqrt{41}$ lies between
 a) 29 and 30 b) 30 and 31 c) 31 and 32 d) 32 and 33
- 3) Oxidation number and co-ordination number of Pt in cisplatin $\text{PtCl}_2(\text{NH}_3)_2$ are respectively
 a) + 4 and 2 b) +2 and 4 c) 0 and 4 d) +2 and 6

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 toiling and moiling 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.

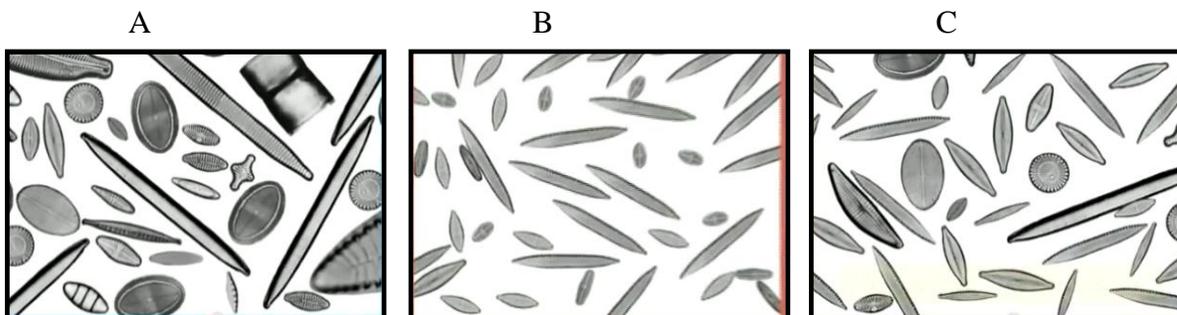
- 5) What could be the most plausible reason that all the ants that toiled and moiled in the summer were happy and content in the winter?
- Ants were probably happy since their food was not shared with Grasshopper.
 - Ants need not worry to work anymore since they had food stocked.
 - Ants were happy since they enjoyed working together in summer.
 - 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
- Of its attitude towards ants who were working tirelessly.
 - Of not having a forethought to store food for the upcoming winter season.
 - Of chirping and singing to its heart's content in the summer.
 - 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 20 m . 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° (b) 37° (c) 60° (d) 30°
- 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 θ is placed in water as shown in figure given below. Consider a small area (ΔA) around point P at a depth h . If Density of water is ρ and acceleration due to gravity is g the force experienced by ΔA due to hydrostatic pressure is
- a) $\rho gh(\Delta A)$ b) $\rho gh(\Delta A)\sin\theta$ c) $\rho gh(\Delta A)\cos\theta$ 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 from 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 $xy^2 = a^3$, $yz^2 = b^3$ and $zx^2 = c^3$ then z^3 equals
 a) $\frac{bc^4}{a^2}$ b) $\frac{b^4c}{a^2}$ c) $\frac{b^2c^4}{a^2}$ d) $\frac{ab^4}{c^2}$
- 15) How many H atoms are in 3.4 g of $C_{12}H_{22}O_{11}$?
 a) 6.0×10^{23} b) 1.3×10^{23} c) 3.8×10^{22} d) 6.0×10^{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 of 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, Stream 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

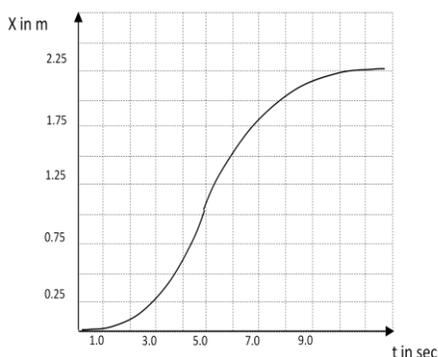
20) Let a, b be two positive real numbers such that $a < b < \frac{1}{a}$ and let $x = \left(a + \frac{1}{a}\right) - \left(b + \frac{1}{b}\right)$. Then

- 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

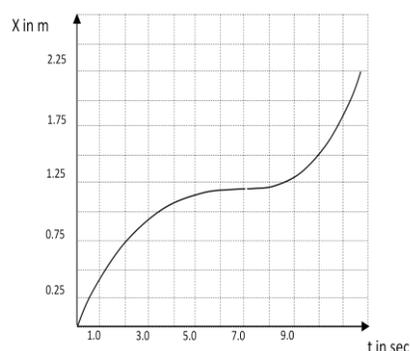
21) Which of the following species has standard enthalpy of formation as 0 kJ mol^{-1} ?

- 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



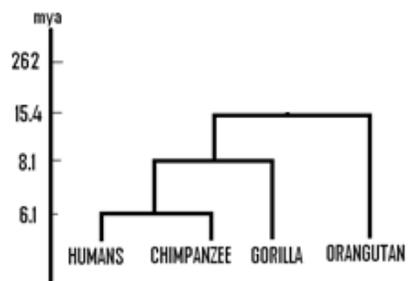
(a)



(b)

- 28) While playing football, Dimple fell down and was badly wounded on her left ankle. 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?
- Prescribed medicine's date was expired.
 - Dimple wouldn't have taken the full course of the antibiotics.
 - Both a & b could be the reason
 - Doctor's inability to prescribe the correct medicine for the wound.
- 29) Which of the following situation is impossible?
- A body having velocity and acceleration in opposite directions.
 - A body having zero velocity and non zero acceleration.
 - A body having constant acceleration and variable velocity.
 - 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?
- $4^h 42^m 50^s$
 - $4^h 43^m 38^s$
 - $4^h 43^m 40^s$
 - $5^h 5^m 27^s$
- 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?
- S_2F_2
 - SF_2
 - SF_4
 - SF_6

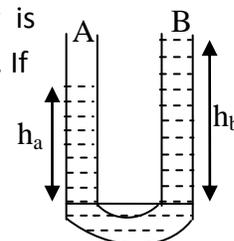
- 32) Given here is a phylogenetic tree (family tree) of greater apes. Which of the following statements cannot be true from the tree? (mya- million years ago)



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

- 33) A liquid (**A**) of density 1.6gcm^{-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

- 0.85 g cm^{-3}
- 3.01 g cm^{-3}
- 0.33 g cm^{-3}
- 1.18 g cm^{-3}

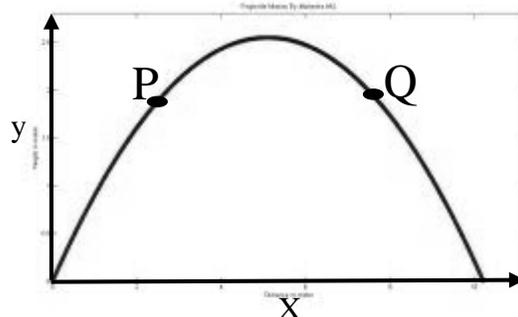
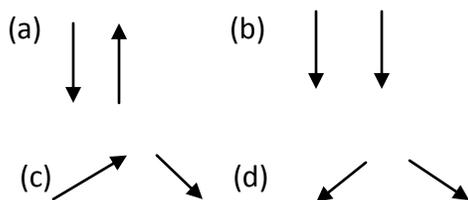


- 34) If **a** and **b** are two positive real numbers such that $\frac{a^2 + b^2}{ab} = 6$, then a positive value of $\frac{a}{b}$ lies between
- 2 and 3
 - 3 and 4
 - 4 and 5
 - 5 and 6

- 35) The isomerism which exists between CH_3CHCl_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°C and heat lost is 96J, then mass of aluminum is

- a) 16g b) 48 g c) 60 g 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
- 44) People residing in coastal area usually do not face the problem of Thyroxin hormone deficiency because their food intake will be rich in one of the following minerals.
 a) Sodium b) Chlorine c) Iodine d) Phosphorus
- 45) In photoelectric effect, the maximum kinetic energy (E_k) of photoelectrons depends on frequency (f) of light incident on a metal surface of work function (ϕ). In an experiment f is varied and E_k is measured. To determine value for Planck's constant (h)
 (a) Plot E_k against ϕ and find intercept of best fitted line.
 (b) Plot E_k against f and find slope of line of best fit.
 (c) Plot E_k against ϕ and find slope of line of best fit.
 (d) Plot E_k against f and find intercept of best fitted line.
- 46) Around a lawn which is of semicircular shape a pavement of uniform width is laid. If the ratio of the area of the lawn to the area of the pavement is 25:24, then the ratio of the outer and inner perimeters of the pavement is
 a) $\frac{7}{5}$ b) $\frac{6}{5}$ c) $\frac{5}{4}$ d) $\frac{5}{2\sqrt{6}}$
- 47) The method that cannot be used for removing permanent hardness of water is
 a) adding sodium carbonate b) distillation
 c) adding caustic soda d) boiling
- 48) In angiosperm plants, companion cell is associated with which one of the following elements?
 a) Sieve tube b) Tracheids c) Vessels d) Xylem fibre
- 49) Essential requirement for the operation of a step down transformer is
 (a) Laminated iron core
 (b) Electrical connection between primary and secondary coils.
 (c) Magnetic interaction between primary and secondary coils
 (d) Non magnetic core.
- 50) Let ABC be a triangle in which $AB = AC$. Let D be a point on AC such that BD bisects angle B .
 Value of the ratio $\frac{AB}{BC}$ is between
 a) 1.0 and 1.5 b) 1.5 and 2.0 c) 2.0 and 2.5 d) 2.5 and 3.0
- 51) Consider the following reaction: $4 PCl_3(g) \rightarrow P_4(g) + 6 Cl_2(g)$. If the initial concentration of $PCl_3(g)$ is 1.0 M, and "x" is the equilibrium concentration of $P_4(g)$, what is the correct equilibrium relation?
 a) $K_c = 6x^7$ b) $K_c = 6x^7/(1.0 - x)^4$
 c) $K_c = (x)(6x)^6/(1.0 - 4x)^4$ d) $K_c = x^7/(1.0 - x)^4$

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

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 \rightarrow Nucleus \rightarrow Chromosome \rightarrow DNA \rightarrow Protein
 b) Nucleus \rightarrow Cell \rightarrow Chromosome \rightarrow DNA \rightarrow Protein
 c) Cell \rightarrow Nucleus \rightarrow DNA \rightarrow Chromosome \rightarrow Protein
 d) Cell \rightarrow Nucleus \rightarrow Protein \rightarrow DNA \rightarrow 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 2×10^{16} each, the current through the hole is given by

- a) 1.6 mA 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) $\frac{1}{1007} + \frac{1}{1008} + \frac{1}{1009} + \dots + \frac{1}{2012}$

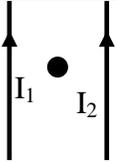
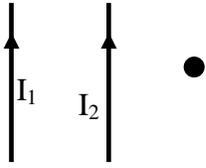
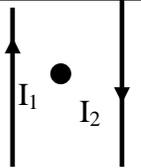
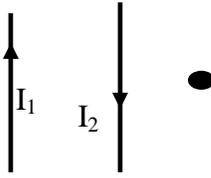
75) Which species below has the same general shape as NH_3 ?

- a) SO_3^{2-} b) CO_3^{2-} c) NO_3^- d) 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) Arthropoda

b) Annelida

c) Arthropoda

d) Nematoda