NATIONAL STANDARD EXAMINATION IN JUNIOR SCIENCE 2016 – 17
Date of Examination – 20th November, 2016
Paper Code : JS532

1. A wooden block (W) is suspended by using a cord from a heavy steel ball (B). The entire system is dropped from a height. Neglecting air resistance, the tension in the cord is
(A) Zero
(B) The differences in the masses of B and W
(C) The differences in the weights of B and W
(D) The weight of B

2. In a n-sided regular polygon, the radius of the circum-circle is equal in length to the shortest diagonal. The number of values of n < 60 for which this can happen is
(A) 0 (B) 1
(C) 10 (D) 2

3. Which of the following does NOT contain living cells?
(A) Bone tissue (B) Xylem sieve tubes
(C) Phloem (D) Epidermis

4. If DNA was made of 6 nucleotides instead of 4, what are the total number of triplet codons possible?
(A) 24 (B) 18
(C) 64 (D) 216

5. A circus performer of weight W is standing on a wire as shown in the adjacent figure. The tension in the wire is

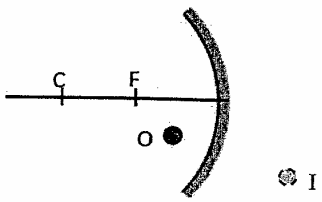
(A) Approximately $\frac{W}{4}$
(B) Approximately $\frac{W}{2}$
(C) Much more than $\frac{W}{2}$
(D) Much less than $\frac{W}{2}$

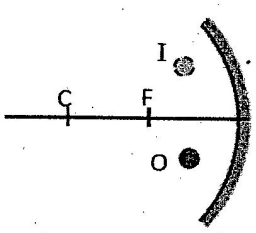
6. Number of integers n such that the number 1 + n is a divisor of the number $1 + n^2$ is
(A) 0 (B) 1
(C) 4 (D) 2

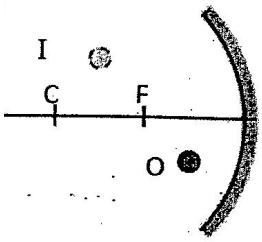
7. When 1 gram of a mixture of aluminium and zinc was treated with HCl, a gas was liberated. At the end of the reaction, the volume of the liberated gas was found to be 524 cm^3, under STP conditions. The individual weights of aluminium and zinc in the mixture, respectively, are
(A) 0.2 g and 0.8 g (B) 0.8 g and 0.2 g
(C) 0.5 g and 0.5 g (D) 0.322 g and 0.678 g

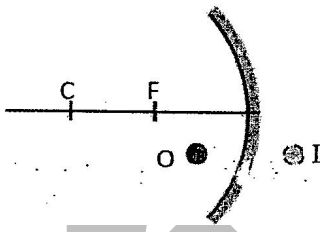
8. Choose the element which is most different from the other three:
(A) Carbon (B) Nitrogen
(C) Silicon (D) Phosphorous

9. In the following diagrams O is point object and I is its image formed by a concave mirror. Indentify the diagram in which position of image I is nearly correct.

(A) 

(B) 

(C) 

(D) 

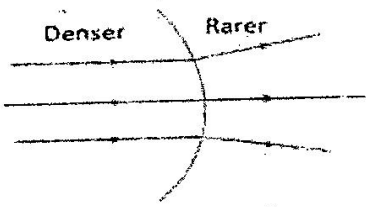
10. If for x, y > 0 we have $\frac{1}{x}+\frac{1}{y}=2$, then the minimum value of xy is

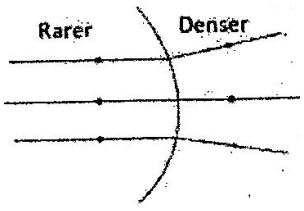
(A) 2 (B) 1
(C) 4 (D) $\sqrt{2}$

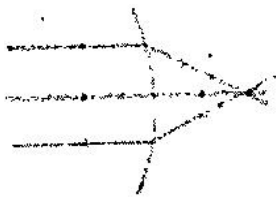
11. Which of these is a mollusc?
(A) Lobster (B) Scorpion
(C) Crab (D) Octopus

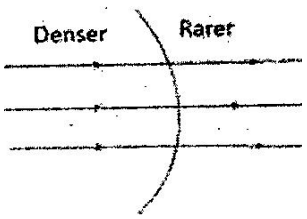
12. What is the mechanism used by the kidneys to remove waste products from the body?
(A) Nephrons convert nitrogenous waste to uric acid and pass it out as urine.
(B) Nephrons actively transport uric acid and other nitrogenous waste A into the proximal and distal convoluted tubules, from where it is collected to form urine.
(C) The blood is filtered to retain cells and large plasma proteins within the blood. The remaining filtrate passes through the proximal and distal convoluted tubules, where needed substances are reabsorbed by active transport.
(D) Nephrons filter out the nitrogenous waste which is passed through the proximal and distal convoluted tubules and collected by the collecting duct as urine.

13. Following diagram shows refraction of parallel beam of light through a spherical surface. Indentify the correct ray diagram

(A) 

(B) 

(C) 

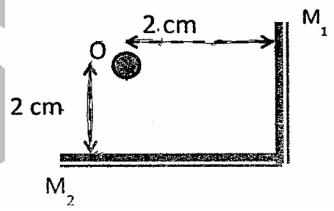
(D) 

14. Tenth term in the sequence 12, 18, 20, 28, … is
(A) 336 (B) 63
(C) 216 (D) 68

15. An electron pair donor is a Lewis base and an electron pair acceptor is a Lewis acid. Which among the following statements, is correct?
(A) NH_3 is a Lewis acid, because nitrogen has only 6 electrons around it.
(B) BF_3 is a Lewis base, because fluorine has 8 electrons around it.
(C) NF_3 is a Lewis base, because nitrogen has a lone electron.
(D) BCl_3 is a Lewis acid because it has only 6 electrons around it.

16. Green house gases absorb (and trap) outgoing infared radiation (heat) from Earth and contribute to global warming. A molecule that acts as a green house gas, generally has a permanent dipole moment and sometimes for other reasons. Going only by the condition of permanent dipole moment, in the list of gases given below, how many can be potential green house gases?
Water, Sulphur dioxide, Boron trifluoride, carbon monoxide, carbon dioxide, nitrogen, oxygen, methane, hydrogen sulphide, ammonia
(A) Five (B) Six
(C) Seven (D) Four

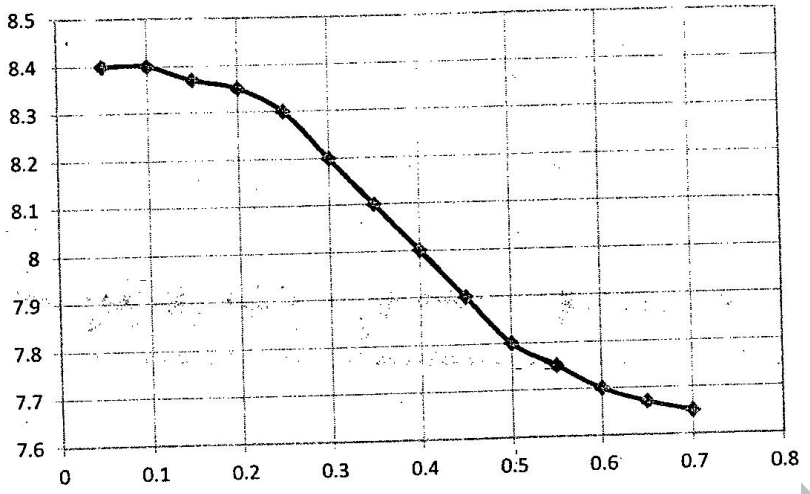
17. In the diagram M_1 and M_2 are two plane mirrors at right angles to each other. O is a luminous point object. Consider two images formed due to first reflection at M_1 and M_2. The area of the triangle formed by the object and two images is
(A) 4 cm^2 (B) 2 cm^2
(C) 8 cm^2 (D) 16 cm^2



18. The probability of a point within an equilateral triangle with side 1- unit lying outside its in-circle (inscribed circle) is
(A) $1-\frac{1}{2(\sqrt{3})}$ (B) $1-\frac{\pi}{3\sqrt{3}}$
(C) $1-\frac{\pi}{2(\sqrt{3})}$ (D) $1-\frac{2\pi}{3(\sqrt{3})}$

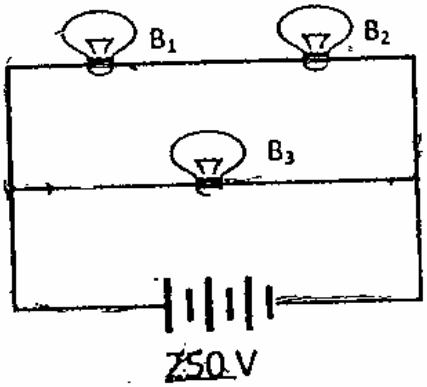
19. Penicillin cannot be used to treat influenza because:
(A) It only helps to bring the temperature down and does not reduce the infection.
(B) The penicillin is broken down by the organism.
(C) Viruses do not have cell walls
(D) Reproduction of protozoans is not affected by penicillin.

20. Thin cuboidal strips are made by slicing a potato, They are all made to be exactly 8 cm long and 2 mm wide. Each strip is placed in sugar solutions of different concentration after soaking it for 5 hours their lengths are measured again. The following graph shows the results of the experiment. What concentration of sugar solution is isotonic with the contents of the cells of the potato.



(A) 0.2 (B) 0.4 (C) 0.6 (D) 0.1

21. Three bulbs B_1, B_2 and B_3 having rated powers 100 W, 60 W and 60 W at 250 V are connected in a circuit as shown in the figure. If W_1, W_2 and W_3 are the output powers of the bulbs B_1, B_2 and B_3 respectively, then



(A) $W_1 > W_2 = W_3$
(B) $W_1 > W_2 > W_3$
(C) $W_1 < W_2 = W_3$
(D) $W_1 < W_2 < W_3$

22. If a, b > 0 then
(A) $a + b \le \sqrt{ab}$ (B) $a + b > \sqrt{ab}$
(C) $a + b \ge \sqrt{2ab}$ (D) None of the above inequalities will hold

23. Which of the following is true about ATP
(A) It is a derivative of one of the nitrogenous bases that from DNA
(B) It splits into ADP and phosphate, and the energy produced is used by muscle cells to contract
(C) It is produced in both aerobic and anaerobic conditions.
(D) All of the above

24. Which of the following statements is true regarding communication in neurons
(A) Free lectrons are moved along the plasma membrane of the axon and control the expression of neutrotransmitters
(B) A chemical signal travels along the axon and is converted into an electric impulse at the synapse
(C) An electric impulse travels along the length of the axon. The electric impulse is converted to a chemical signal at the synapse,
(D) An electrical signal is converted to a chemical signal by the Myelin sheath before it reaches the synapse

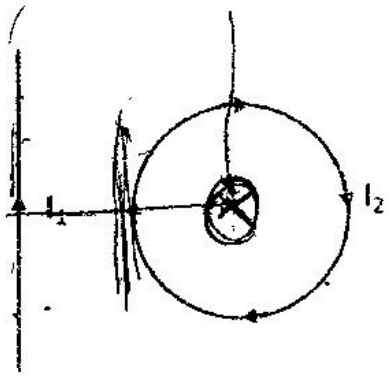
25. Rod AB of radius 2r is joined with rod BC of radius r. They are of same material and are of same length. The combination carries a current I.
Choose the correct statement
(A) $V_{AB} = 4V_{BC}$
(B) Current per unit area in AB and BC are equal
(C) Resistance of AB is greater than that of BC
(D) $V_{BC} = 4V_{AB}$

26. The statement "a is not less than 4" is correctly represented by
(A) $a < 4$ (B) $a > 4$
(C) $a \geq 4$ (D) $a \leq 4$

27. A chemist mixes two ideal liquids A and B to form a homogeneous mixture. The densities of the liquids are 2.0 g/mL for A and 3 g/mL for B. When she drops a small object into the mixture, she finds that the object becomes suspended in the liquid; that is, it neither sinks to the bottom nor does it float on the surface. If the mixture is made of 40% A and 60%B, by volume, what is the density of the object?
(A) $2.60\ g/mL$ (B) $2.50 g/mL$
(C) $2.40 g/mL$ (D) $1.50 g/mL$

28. How many different compounds can have the formula, C_3H_4 ?
(A) One (B) Two
(C) Three (D) Four

29. In the figure shown, the current carrying loop is fixed, where as current carrying straight conductor is free to move. Then straight wire will (ignore gravity)
(A) remain stationary
(B) move towards the loop
(C) move away from the loop
(D) rotate about the axis perpendicular to plane of paper



30. Two friends A and B watched a car from the top of their buildings. Angle of depression for A was more than angle of depression for B, then
(A) A's apartment is taller than B's apartment
(B) B's apartment is taller than A's apartment
(C) A's apartment and B's apartment have same height
(D) We cannot compare the heights of the two apartments

31. How many times would a red blood cell pass through the heart during one complete cycle?
(A) Once
(B) Twice
(C) 4 times
(D) 72 times

32. A gene has two alleles P (dominant) and p(recessive). The homozygous recessive combination leads to death in the embryo stage. If two individuals with genotype Pp are mated, out of the offspring that survive to adulthood, what is the probability of the genotype to be Pp?
(A) 0.75
(B) 0.33
(C) 0.5
(D) 0.67

33. A convex mirror of focal length f produces an image of size equal to $\frac{1}{n}$ times the size of the object. Then the object distance is
(A) nf
(B) $\frac{f}{n}$
(C) $(n+1)f$
(D) $(n-1)f$

34. Total surface area of a sphere S with radius $\left(\sqrt{2}+\sqrt{3}\right)$ cm is
(A) $400\pi\left(5+2\sqrt{6}\right)$sqmm
(B) $\pi\left(\sqrt{2}+\sqrt{3}\right)^2$ sqcm
(C) $2\pi\left(\sqrt{2}+\sqrt{3}\right)^2$ sqcm
(D) $40\pi\left(5+2\sqrt{6}\right)$sqmm

35. There are many elements in the periodic table that are named after the country, where they were first made or obtained. For example, the Latin name for copper was coined by the Romans because their chief source of copper was from the island of Cyprus. However, there is one country in the world which was named after an element (the Latin name). A long time ago, it was believed that this country had mountains full of a valuable element, however all expeditions to find these mountains failed. But the name stuck on. The element in question is used for many applications today, and many of its compounds are used as catalysts. The ions of this metal have very good anti – microbial property and finds application in water purification. The element is
(A) Sodium
(B) Gold
(C) Silver
(D) Francium

36. All of these species have the same number of valence electrons as nitrate ion, except
(A) Carbonate ion
(B) Bicarbonate ion
(C) NF_3
(D) SO_3

37. The angle between the hour arm and the minute arm of a clock at 2:10 a.m. is
(A) Zero
(B) 4^o
(C) 5^o
(D) 6^o

38. A craft teacher reshapes the wax from a cylinder of candle with section diameter 6 cm and the height 6 cm into a sphere. The radius of this sphere will be:
(A) $r = 6\sqrt{\frac{3}{2}}$ cm
(B) $r = 6$ cm
(C) $r = 3\sqrt[3]{\frac{3}{2}}$ cm
(D) $r = 6\sqrt[3]{2}$ cm

39. Plants absorb nitrates from the soil, which are most essential to produce:
(A) Proteins (B) Carbohydrates
(C) Fats (D) Cell wall

40. The dry mass (mass excluding water) of a seed in the process of germination:
(A) increases over time until the first leaves appear
(B) decreases over time until the first leaves appear
(C) stays constant until the first leaves appear
(D) first increases and then decrease until the first leaves appear.

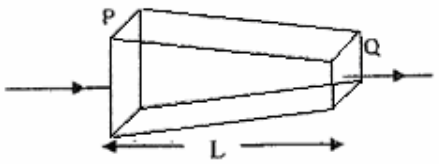
41. Two bodies A and B are charged with equal magnitude of charge but A with positive charge and B with negative. If M_A and M_B are masses before charging and M'_A and M'_B are the masses after charging, then (m_0 is some constant mass)
(A) $M'_A = M_A + m_0$ and $M'_B = M_B + m_0$ (B) $M'_A = M_A - m_0$ and $M'_B = M_B + m_0$
(C) $M'_A = M'_B$ (D) $M'_A = M_A - \frac{m_0}{2}$ and $M'_B = M_B + m_0$

42. The number of natural numbers $n \leq 30$ for which $\sqrt{n+\sqrt{n+\sqrt{n+....}}}$ is a natural number is
(A) 30 (B) Zero
(C) 6 (D) 5

43. Element A, B and C have atomic number X, X +1 and X+2, respectively. 'C' in an alkali metal 'A' reacts with another element 'Y' to form the compound 'AY''. 'A' and 'Y' belong to the same group. 'AY' possesses an
(A) ionic bond (B) covalent bond
(C) metallic bonding (D) coordinate bond

44. Air has three major components nitrogen, oxygen and argon. Given that one mole of air at sea level is made up of 78% nitrogen, 21% oxygen and 1% argon, by volume. What is the density of air? Assume that gases behave in an ideal manner. (Atomic mass of argon is 40 amu)
(A) 14.62 g/L (B) 1.3 g/L
(C) 29 g/L (D) 0.65 g/L

45. A conductor of length L has a varying cross section with area 2A at P and A at Q as shown in the adjacent figure. It carried a steady current I, then
(A) Net charge per unit volume near P is more than net charge per unit volume near Q.
(B) Net charge per unit volume near Q is less than net charge per unit volume.
(C) Current per unit area near P is more than current per unit area near Q.
(D) Current per unit area near P is less than current per unit area near Q



46. The number of natural numbers $n \leq 30$ for which $\sqrt{n+\sqrt{n+\sqrt{n+....}}}$ is a prime number is
(A) 3 (B) Zero
(C) 9 (D) 2

47. Rhodoferax fermentans is a species of photynthetic bacterial. From your knowledge about bacteria in general, identify the components that cannot be present in this organism
(A) Chloroplasts (B) ATP
(C) Ribosomes (D) Cell wall

48. If atomospheric humidity decreases, transpiration rate
(A) decreases because the concentration gradient between the mesophyll and the atmosphere decreases.
(B) Stays the same because active transport does not depend on humidity
(C) Increases because of the higher concentration gradient between the air spaces of the mesophyll and the atmosphere
(D) decreases because the concentration of water vapour decreases

49. Vessels A and B are made of conducting material. Both contain water. Vessel A floats in B. Vessel B is now heated at a uniform rate, then
(A) water in A boils first
(B) water in A boils some time after water in B starts boiling
(C) water in both A and B start boiling simultaneously
(D) water in A does not boil

50. The number of squares formed by 5 vertical and 4 horizontal lines(all are equispaced) is
(A) 60 (B) 20
(C) 40 (D) 46

51. If 0.50 mole of a monovalent metal (M^{+1}) halide is mixed with 0.2 mole of a divalent metal (L^{+2}) phosphate, the maximum number of moles of M_3PO_4 that can be formed is
(A) 0.25 (B) 0.30
(C) 0.16 (D) 0.20

52. Every major city in India has a pollution control board to monitor air and water pollution. The following data is from three localities in Bangalore city from the year 2015.

Locality	Annual average of SO_2 in the air (volume/volume)
P	16.3 mL/m^3
Y	16.3 ppb (m^3/m^3)
Z	16.3 ppm (m^3/m^3)

ppb stands for parts per billion and ppm stands for parts per million. These are different units to express concentration. They are very similar to percentage(which is actually parts per hundred)
Base on the above data, which place will you choose to live in?
(A) All localities are equally polluted, so I have no preference
(B) P is more polluted than Y and Z, hence I will live in either Y or Z
(C) Locality Y is least polluted, hence I will live in Y
(D) Z and Y are more polluted than P, hence I will live in P

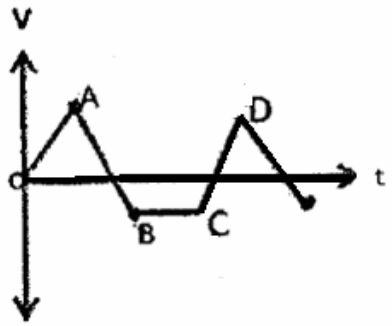
53. A body thrown vertically up reaches a maximum height and returns back. Its acceleration is
(A) downward during both ascent and descent
(B) downward at all position except at the highest point, where it is zero
(C) upward during both ascent and descent
(D) downward during ascent and upward during descent

54. The number of integers a, b, c for which $a^2 + b^2 - 8c = 3$ is
(A) 2 (B) Infinite
(C) 0 (D) 4

55. Which of the following is NOT produced by the endoplasmic reticulum?
(A) Lipids (B) Proteins
(C) Monosaccharides (D) Hormones

56. Vaccines prevent infection by pathogens by
(A) presenting the body's immune system with antigens in a controlled manner, so that it is prepared to counter the pathogen producing it when it attempts to infect the body.
(B) affecting the reproductive cycle of the invading pathogen
(C) binding to antigens on the surface of the pathogen and inactivating it
(D) affecting the metabolic pathways of pathogen

57. Velocity of a particle moving along a straight line varies with time as shown in the adjacent figure. Net forces acting on the particle are F_1, F_2, F_3, F_4 and F_5 in the intervals OA, AB, BC and DE respectively. Identify the correct statement



(A) F_1 increases with time
(B) F_5 is initially positive and then becomes negative
(C) F_1 and F_2 are in opposite directions
(D) F_3 in negative

58. If set X consists of three elements then the number of elements in the power set of power set of X is
(A) 3^3 (B) 2^3
(C) 3^8 (D) 2^8

59. The heat of neutralization of CH_3COOH, HCOOH, HCN and H_2S are -55.2, -56.07, -2.8 and -3.34 kJ per equivalent respectively. The increasing order of strength of these acids is
(A) HCOOH < CH_3COOH < H_2S < HCN (B) H_2S < HCN < HCOOH < CH_3COOH
(C) HCN < H_2S < CH_3COOH < HCOOH (D) CH_3COOH < HCOOH < HCN < H_2S

60. To prevent the formation of oxides, peroxides and superoxides, alkali metals are sometimes stored in an unreactive atmosphere. Which of the following gases should not be used for lithium
(A) Ne (B) Ar
(C) N_2 (D) Kr

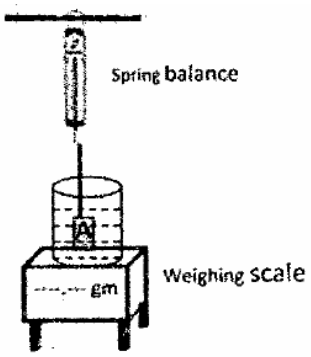
61. A fisherman of height h is standing on the bank of a lake. A fish in the water perceives his height as h'. Then
(A) h' > h (B) h' < h
(C) h' = h (D) h' > h or h' < h depending or position of fish

62. A triangle has perimeter 316 and its sides are of integer length. The maximum possible area for such a triangle is achieved for
(A) Single triangle (B) Two triangles
(C) Three triangles (D) More than three triangles

63. Henning Brand, one of the many alchemists was in pursuit of the philosopher's stone. Brand's method is believed to have consisted of evaporating large quantities of urine to leave a black residue that was then left for a few months. The residue was then heated with sand, driving off a variety of gases and oils. The final substance to be driven off, was condensed as a white solid, which he called as 'cold fire' as it was luminous and glowed in the dark and also caught fire on slight warming and producing a large quantity of light. It has also been called as the 'Bearer of light'. Which element is 'cold fire'?
(A) Lithium (B) Tungsten
(C) Phosphorous (D) Cesium

64. When solid KOH is mixed with solid NH_4Cl, a gas is produced. Which gas is it?
(A) Chlorine (B) Hydrogen
(C) Hydrogen chloride (D) Ammonia

65. Object A is completely immersed in water. True weight of object A is W_A. Weight of water with beaker is W_B. Let B be the buoyant force. W_1 and W_2 are scale readings of spring balance and weighing scale respectively.

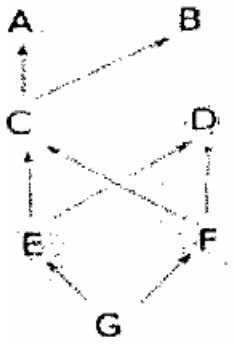


(A) $W_1 = W_A$ (B) $W_1 = W_A + B$
(C) $W_2 = W_B$ (D) $W_2 = W_B + B$

66. Number of numbers less than 40 having exactly four divisors is
(A) 15 (B) 12
(C) 11 (D) 14

67. Antibodies play an important role in defending the body against infections by which of the following mechanisms:
(A) they engulf the bacteria and make them harmless
(B) they bind to the surface of pathogens, so that they can be eassily identified and removed by other cells of the immune system
(C) they enter the pathogen and prevent cell division
(D) they are highly reactive and chemically react with the DNA of the pathogen

68. The figure shows a food web, where A, B, C, D etc. are different species. And the direction of the arrows symbolizes the direction of flow of nutrients.
As increases in the population of which species is likely to decrease the population of species A.



(A) Species D (B) Species F
(C) Species G (D) Species E

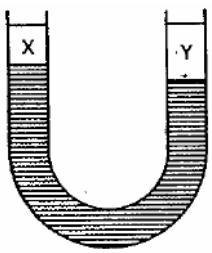
69. A point object O is kept at origin. When a concave mirror M_1 places at x = 6 cm, image is formed at infinity. When M_1 is replaced by another concave mirror M_2 at same position, image is formed at x = 30 cm, then ratio of the focal length of M_1 to that of M_2 is
(A) 3/4 (B) 4/3
(C) 5 (D) 1/5

70. The number $3^8\left(3^{10}+6^5\right)+2^3\left(2^{12}+6^7\right)$ is
(A) A perfect square and a perfect cube (B) Neither a perfect square nor a perfect cube
(C) A perfect cube but not a perfect square (D) A perfect square but not a perfect cube

71. Melting point of a substances is 10^o C. What does this mean?
(A) The substance is a liquid at 10^o C
(B) The substance is a solid at 10^o C
(C) There is an equilibrium between solid phase and liquid phase at 10^o C
(D) The substance is 50% solid and 50% liquid at 10^o C

72. The following substances have approximately same molecular mass. Which is likely to have the highest boiling point?
(A) n – butane (B) isobutane
(C) n – butanol (D) isobutanol

73. U – tube contains some amount of mercury. Immiscible Liquid X is poured in left immiscible liquid Y is poured in the right arm. Length of liquid X is 8 cm, length Y is 10 cm and upper levels of X and Y are equal. If density of Y is 3.36 g cm^{-3} and 13.6 g cm^{-3} then density of X is



arm of liquid of Hg is

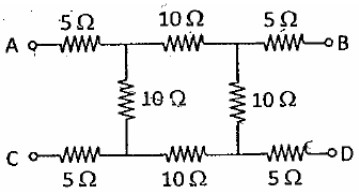
(A) 0.8 g cm^{-3} (B) 1.2 c cm^{-3}
(C) 1.4 g cm^{-3} (D) 1.6 g cm^{-3}

74. Let the number of rectangles formed by 6 horizontal and 4 vertical lines be n and those formed by 5 vertical and 5 horizontal lines be m then we have
(A) n = m (B) $n \geq m + 1$
(C) $m \geq n$ (D) $m > n + 5$

75. In a human cell undergoing Meiosis, what are the total number of cellular DNA molecules present during Prophase – I.
(A) 23 (B) 46
(C) 69 (D) 92

76. During gaseous exchange in the alveoli, what happens to nitrogen?
(A) there is no net nitrogen exchange, as nitrogen is filtered out by the alveoli
(B) the nitrogen is absorbed by the alveolus to form amino acids
(C) the nitrogen is filtered out by the alveolus, as the nitrogen molecule is too large to cross the gaps in the capillaries
(D) there is no net nitrogen exchange, as the blood is saturated with nitrogen

77. The effective resistance between A and D is the circuit shown in the adjacent figure is



(A) 5 Ω (B) 10 Ω
(C) 15 Ω (D) 20 Ω

78. If ABCD is a rhombus and $\angle ABC = 60^{o}$ then
(A) the points A, B, C, D are concyclic
(B) the quadrilateral has exactly half the area of the square with same sides as ABCD
(C) the quadrilateral has area $\frac{\sqrt{3}}{2} AB^2$
(D) the diagonals of the quadrilateral ABCD are equal and bisect each other at right angle

79. Identify the overall change in the following set of reactions:
1. Carbon dioxide $\rightarrow$ carbonic acid (H_2CO_3)
2. Ethanol (alcohol) $\rightarrow$ Ethanal (aldehyde)
3. Ethanal (aldehydel) $\rightarrow$ Ethanol (alcohol)
4. Sulphuric acid $\rightarrow$ Sulphur trioxide (SO_3)
Choose the correct options which best describes these conversions:
(A) oxidation, oxidation, reduction, reduction
(B) hydration, oxidation, reduction, dehydration
(C) reduction, dehydration, hydration, oxidation
(D) reduction, reduction, oxidation, oxidation

80. An element with atomic number 44, is below which element in the periodic table?
(A) Calcium
(B) Iron
(C) Argon
(D) Magnesium