SEAL

Test Booklet Number	Subject Code - 1501	Roll Number
01601	**MATHEMATICS & SCIENCE**	

[Time : 2 Hours] [Maximum Marks : 300]

INSTRUCTIONS TO CANDIDATES

Read the following instructions carefully before you answer the questions given in this Test Booklet :

1. Answers to questions in this Test Booklet are to be given on an **OMR Answer Sheet** provided to the candidate **separately.**
2. Candidate must fill up Name, Category, Test Booklet Number, Subject Code and Roll Number in the Answer Sheet carefully as per instructions given.
3. This Test Booklet consists of 75 questions. All questions are compulsory and carry equal marks.
4. Each question in this Test Booklet has four possible alternative answers namely, (A), (B), (C) and (D), one of which is correct. Candidate should choose the correct answer against each question out of four alternative answers.
5. Candidate is instructed to answer the questions by **darkening** (●) with **Ball Point Pen** only in the circle bearing the correct answer.
6. Candidate should not attempt more than one answer in each question. More than one attempt in any form against a question shall be treated as incorrect.
7. Marking of answer other than darkening shall be cancelled and darkening should remain within the circle or otherwise computer shall not accept during evaluation of answer-script.
8. Rough work must not be done on the Answer Sheet. Use the blank space given in the Test Booklet for rough work.
9. Candidate is to hand over the Answer Sheet to the Invigilator before leaving the Examination Hall.
10. **NEGATIVE MARKING** : Each question carries 4 (four) marks for correct response. For each incorrect response, 1 (one) mark will be deducted from the total score. More than one answer indicated against a question will be deemed as incorrect response and will be negatively marked.

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MATHEMATICS

1. If $ab + bc + ca = 1$, then the value of $\frac{a+b}{1-ab} + \frac{b+c}{1-bc} + \frac{c+a}{1-ca}$ is

(A) $(a+b)(b+c)(c+a)$

(B) abc

(C) $\frac{1}{abc}$

(D) $\frac{1}{(1-ab)(1-bc)(1-ca)}$

2. The value of x in $|x-2| = 12$ is

(A) 14, 10

(B) 14, – 10

(C) – 14, – 10

(D) – 14, 10

3. If $x = 3 + \sqrt{8}$, then $x^3 + \frac{1}{x^3}$ equals :

(A) 216

(B) 261

(C) 198

(D) 192

4. If the polynomials $kx^3 + 3x^2 - 13$ and $2x^3 - 5x + k$ leave the same remainder when divided by $x - 2$, the value of k is

(A) 2

(B) 1

(C) 3

(D) 4

5. $8a^3 - 2a^2b - 15ab^2$ on factorisation gives

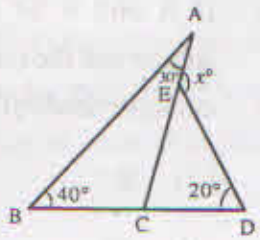
(A) $(4a + 5b)(2a^2 - 3ab)$

(B) $(4a - 5b)(2a^2 - 3ab)$

(C) $(4a - 5b)(2a^2 + 3ab)$

(D) $(4a + 5b)(2a^2 + 3ab)$

6. In the adjoining figure, the value of x is



(A) 60°

(B) 80°

(C) 70°

(D) 90°

7. In a ΔABC, if $2\angle A = 3\angle B = 6\angle C$, then $\angle A, \angle B, \angle C$ are

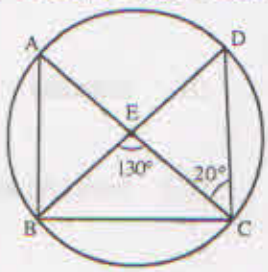
(A) 30°, 60°, 90°

(B) 90°, 60°, 30°

(C) 30°, 90°, 60°

(D) 90°, 30°, 60°

8. A, B, C and D are four concyclic points. AC and BD intersect at a point E such that $\angle BEC = 130°$ and $\angle ECD = 20°$, then $\angle BAC$ is



(A) 90°

(B) 100°

(C) 110°

(D) 120°

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9. The diagonal of a rectangle is inclined to one side of the rectangle at 25°. The acute angle between the diagonals is

(A) 25°

(B) 40°

(C) 50°

(D) 65°

10. If A and B be the surface area of a sphere and the curved surface area of the circumscribed cylinder, then A is equal to

(A) B

(B) 2B

(C) $\frac{1}{2}$B

(D) $\frac{2}{3}$B

11. The sum of rational and irrational number is always

(A) rational

(B) irrational

(C) both (A) and (B)

(D) can't say

12. If α, β are the roots of the quadratic equation $x^2 + ax + b = 0$, where $b \neq 0$, then the roots of the quadratic equation $bx^2 + ax + 1 = 0$ are :

(A) $\frac{\alpha}{\beta}, \frac{\beta}{\alpha}$

(B) $\frac{1}{\alpha}, \frac{1}{\beta}$

(C) α^2, β^2

(D) $\frac{1}{\alpha^2}, \frac{1}{\beta^2}$

13. If the quadratic equation $(1+m^2)x^2 + 2mex + c^2 - a^2 = 0$ in x has equal roots, then

(A) $a^2 = c^2(1 + m^2)$

(B) $c^2 = a^2(1 + m^2)$

(C) $c^2 = a^2(1 - m^2)$

(D) $a^2 = c^2(1 - m^2)$

14. A three wheeler charges Rs. 10 for first kilometer and Rs. 5 per km subsequently. For a distance of x km, Rs. y are paid. The linear equation representing this information is

(A) $5x - y + 5 = 0$

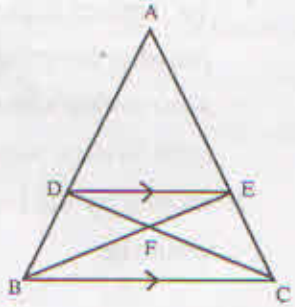
(B) $5x - y + 10 = 0$

(C) $5x - y - 10 = 0$

(D) $10x - y + 5 = 0$

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15. In ΔABC, $DE \parallel BC$ and $\frac{AD}{DB} = \frac{5}{4}$. The ratio between the area of ΔDEF and area of ΔCBF is



(A) 5 : 9

(B) 9 : 5

(C) 25 : 81

(D) 81 : 25

16. If tangents PA and PB from an external point p to q circle with centre O are inclined to each other at 80°, then $\angle POA$ is

(A) 100°

(B) 50°

(C) 10°

(D) 120°

17. If $\frac{\cos\alpha}{\cos\beta} = m$ and $\frac{\cos\alpha}{\sin\beta} = n$, then value of $(m^2 + n^2)\cos^2\beta$ is :

(A) m^2

(B) n^2

(C) m

(D) n

18. A boat is being rowed away from a cliff 150 m high. The angle of elevation of the boat to the cliff changes from 60° to 45° in 1 minute. If $\sqrt{3} = 1.73$, the speed of the boat is :

(A) 4.63 km/hr.

(B) 4.31 km/hr.

(C) 3.91 km/hr.

(D) 3.81 km/hr.

19. The internal and external radii of a hollow sphere are 3 cm and 5 cm respectively. It is melted to form a solid cylinder of height $2\frac{2}{3}$ cm. The radius of base of cylinder formed is

(A) 3.5 cm

(B) 5.25 cm

(C) 6.14 cm

(D) 7 cm

20. The probability of getting 53 Thursdays in a leap year is

(A) $\frac{1}{7}$

(B) $\frac{2}{7}$

(C) $\frac{3}{7}$

(D) $\frac{1}{2}$

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21. A student decides to show speed along the x-axis and time along the y-axis to plot speed-time graph for the motion of an object moving with a constant speed v. The graph plotted by the student will be a straight line

(A) along the x-axis

(B) along the y-axis

(C) parallel to the x-axis

(D) parallel to the y-axis

22. Which of the following quantity remains constant in a uniform circular motion ?

(A) Displacement

(B) Speed

(C) Velocity

(D) Acceleration

23. A bus driver moving with a constant speed 'v' applies brakes and the bus comes to rest after covering a distance 'd'. If the bus was moving with a constant speed 2 v at the time brakes were applied, the distance moved by the bus before coming to rest would be

(A) 2d

(B) 4d

(C) 8d

(D) 16d

24. From a rifle of mass 4.8 kg a bullet of mass 20 g is fired with an initial speed of 30 ms^{-1}. The speed with which the gun recoils is

(A) 2.40 cms^{-1}

(B) 6.25 cms^{-1}

(C) 12.50 cms^{-1}

(D) 25.00 cms^{-1}

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25. A ball of mass 'm' moving with a velocity 'v' along a horizontal direction strikes a vertical wall and bounces off along the same horizontal line. If the velocity of the ball after striking the wall be $\frac{1}{2}$ v, the change in the momentum of the ball and its kinetic energy will respectively be

(A) $\frac{3}{2}$ mv and $\frac{1}{2}$ mv^2

(B) $\frac{3}{2}$ mv and $\frac{3}{4}$ mv^2

(C) $\frac{1}{2}$ mv and $\frac{1}{2}$ mv^2

(D) $\frac{1}{2}$ mv and $\frac{1}{4}$ mv^2

26. The mass and radius of a planet P are two times that of the earth. If the acceleration due to gravitation on the planet be g_p and that on the earth be g_e, then

(A) $g_p = 4\, g_e$

(B) $g_p = 2\, g_e$

(C) $g_p = \frac{1}{2} g_e$

(D) $g_p = \frac{1}{4} g_e$

27. A swimmer dives horizontally from a diving board with a horizontal velocity of 9 kmh^{-1}. The swimmer touches the water surface at a distance of 2.5 m from the point of diving. If the acceleration due to gravity at the place of diving is 10 ms^{-2}, the height of the diving board above the water surface is

(A) 4.5 m

(B) 5.0 m

(C) 9.0 m

(D) 10.0 m

28. A food packet is dropped from a helicopter held stationary at 500 m above the ground level. The ratio of the distance through which the food packet would fall in first 6 seconds to that it had fallen in the first 3 seconds will be

(A) 16 : 1

(B) 8 : 1

(C) 4 : 1

(D) 2 : 1

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29. A cuboid of mass 500 gram and volume 250 cm^3 when immersed in water of density 1 g/cm^3, sinks to the bottom. The force of Buoyancy experienced by the cuboid is :

(A) 100 gwt

(B) 150 gwt

(C) 200 gwt

(D) 250 gwt

30. A sound wave of frequency 500 Hz is moving with a speed of 300 m/s. The horizontal distance between a crest and its adjacent through of this wave will be

(A) 30 cm

(B) 60 cm

(C) nearly 83 cm

(D) nearly 167 cm

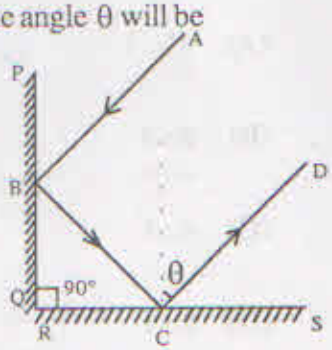
31. Two plane mirrors PQ and RS are held such that the angle between them is 90°. A ray of light AB is incident on the mirror PQ as shown. If the angle of incidence for the ray AB be 35°, the angle θ will be

(A) 35°

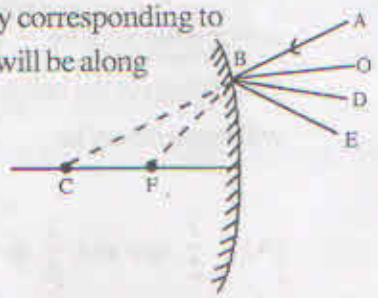
(B) 45°

(C) 55°

(D) 65°



32. In the ray diagram a ray of light AB is shown incident on a convex mirror.
If C and F are the centre of curvature and principal focus of the mirror respectively, the reflected ray corresponding to the ray AB will be along



(A) BA

(B) BO

(C) BD

(D) BE

33. If the refractive indices of three media, A, B and C are n_A, n_B and n_C respectively such that $n_A > n_B > n_C$, and the velocities of light in these media are C_A, C_B and C_C respectively and C is the velocity of light in air/vacuum, then which of the following will be the correct option ?

(A) $C_A > C_B > C_C > C$

(B) $C > C_C > C_B > C_A$

(C) $C_A < C_B < C_C > C$

(D) $\frac{C}{C_A} < \frac{C}{C_B} < \frac{C}{C_C}$

34. A bright object AB lies between F_1 and $2F_1$ of a convex lens. If the image of AB falls at the centre of curvature of a concave mirror, then, as compared to AB, the final image will be :

(A) erect and diminished

(B) erect and magnified

(C) inverted and diminished

(D) inverted and magnified

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35. The formation of rainbow in the sky is due to a combined affect of the phenomena of

(A) reflection, refraction and diffusion

(B) refraction, internal refraction and scattering

(C) refraction, dispersion and internal reflection

(D) refraction, dispersion and scattering

36. A wire of length 5 m has a resistance of 10 ohms. It is stretched to double the length, the resistance of the stretched wire is :

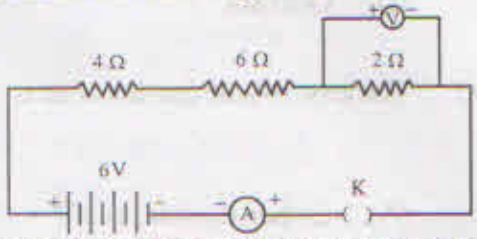
(A) 10 ohms

(B) 20 ohms

(C) 30 ohms

(D) 40 ohms

37. Consider the following circuit :



If the key is plugged in, the reading of the ammeter and the voltmeter would respectively be

(A) 1.0 A and 2.0 V

(B) 1.0 A and 0.5 V

(C) 0.5 A and 1.0 V

(D) 0.5 A and 6.0 V

38. Consider the shape of field lines of the following :

I. Single positive charge
II. Current carrying straight conductor
III. Current carrying solenoid
IV. A bar magnet

Which of the above have field lines of the shape of a closed loop ?

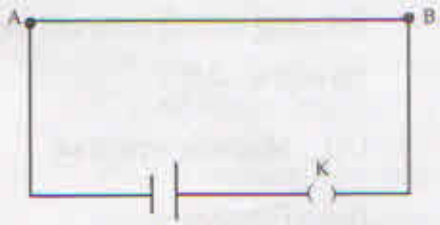
(A) I, II and III

(B) II, III and IV

(C) only III and IV

(D) only I and II

39. A straight conductor AB is connected to a cell through a key as shown in the given circuit diagram.



If the key K is plugged in, the direction of current in the circuit will be along

(A) AB while the direction of magnetic field associated with it will be anticlockwise

(B) AB while the direction of magnetic field associated with it will be clockwise

(C) BA while the direction of magnetic field associated with it will be anticlockwise

(D) BA while the direction of magnetic field associated with it will be clockwise

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40. A beam of positive charges flowing towards east is deflected to the north direction by a magnetic field. Direction of the magnetic field is :

(A) coming out of the plane of the paper

(B) going into the plane of the paper

(C) pointing southwards

(D) pointing westwards

41. A car mechanic noticed small metallic pieces in the engine oil of a car. Which of the following techniques he will use for cleaning the engine oil ?

(A) Magnetic separation

(B) Filtration

(C) Centrifugation

(D) Evaporation

42. Consider the following substances :

I. iodine
II. ammonium hydroxide
III. dry ice
IV. ammonium chloride

The phenomenon of sublimation would be observed in

(A) I and II only

(B) III and IV only

(C) I, III and IV

(D) I, II and IV

43. The atomic numbers of six elements, a, b, c, d, e and f are 3, 4, 5, 7, 10 and 13 respectively. The elements having same valency are :

(A) a, b and c

(B) c, d and e

(C) c, d and f

(D) b, c and d

44. Which of the following will **not** show Tyndall effect ?

(A) Soap Solution

(B) Sugar Solution

(C) Starch Solution

(D) Gold Sol

45. The least volatile fraction of air is

(A) Carbon dioxide

(B) Oxygen

(C) Argon

(D) Nitrogen

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46. Atomic mass of oxygen is 16u and the Avogadro number is 6.022×10^{23}. The mass of 12.044×10^{23} molecules of oxygen would be –

(A) 8 grams

(B) 16 grams

(C) 32 grams

(D) 64 grams

47. Rutherford's α-particle scattering experiment showed that

I. electrons have negative charge

II. the mass and positive charge of the atom is concentrated in the nucleus

III. neutrons exist in the nucleus

IV. most of the space in the atom is empty

The correct statements are

(A) I, II and III

(B) II, III and IV

(C) II and IV only

(D) III and IV only

48. The species represented by $^{18}_{8}O^{2-}$ contains

(A) 8 protons, 10 neutrons and 6 electrons

(B) 8 protons, 10 neutrons and 8 electrons

(C) 8 neutrons, 18 protons and 10 electrons

(D) 10 neutrons, 8 protons and 10 electrons

49. The atom of an element has 6 electrons in its L-shell. From this information, it can be inferred that the element –

(A) has 6 protons in its nuclei and that it is carbon

(B) can acquire two electrons to form its ion and that its valency is two

(C) is a metal and will form a positive ion

(D) is a metal and will form only covalent bond

50. The canal rays

(A) Which consist of positively charged particles were discovered by E. Goldstein in 1886

(B) Which consist of negatively charged electrons were discovered by J. J. Thomson

(C) Were used by E. Rutherford in his experiment to bombard the atoms

(D) led Niels Bohr to formulate his ideas about the structure of atom

51. The reaction between calcium oxide and water is an example of a

(A) combination reaction which is exothermic

(B) combination reaction which is endothermic

(C) displacement reaction which is exothermic

(D) redox reaction which is endothermic

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52. The pH of a sample of milk is 6. The pH of the curds formed with this sample of milk is likely to be between

(A) 7 and 8

(B) 6 and 7

(C) 5 and 6

(D) 3 and 4

53. Based on the reactions given below, select from the following the correct decreasing order of the reactivity of the metals involved in the reactants :

(i) $Zn_{(s)} + CuSO_{4(aq)} \rightarrow ZnSO_{4(aq)} + Cu_{(s)}$

(ii) $Cu_{(s)} + 2AgNO_{3(aq)} \rightarrow Cu(NO_3)_{2(aq)} + 2Ag_{(s)}$

(iii) $Zn_{(s)} + FeSO_{4(aq)} \rightarrow ZnSO_{4(aq)} + Fe_{(s)}$

(iv) $Fe_{(s)} + CuSO_{4(aq)} \rightarrow FeSO_{4(aq)} + Cu_{(s)}$

(A) Zn > Ag > Fe > Cu

(B) Zn > Fe > Cu > Ag

(C) Ag > Cu > Zn > Fe

(D) Fe > Zn > Cu > Ag

54. The sequence of steps involved in the extraction of a certain metal is as shown below :

Ore → roasting → metal → refining

The ore may consist of

(A) sulphide or a carbonate of a metal of medium reactivity

(B) sulphide of a metal of low reactivity

(C) sulphide of a metal of high reactivity

(D) carbonate of a metal of low reactivity

55. An alkyne has six carbon atoms in its one molecule. The number of hydrogen atoms in this molecule will be :

(A) 6

(B) 8

(C) 10

(D) 12

56. In which of the following pairs both compounds are unsaturated ?

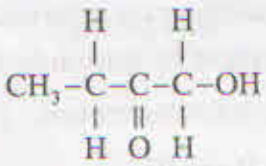
(A) C_2H_6 and C_4H_6

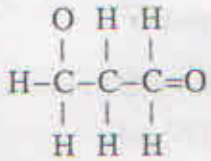
(B) C_6H_{12} and C_5H_{12}

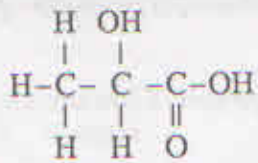
(C) C_4H_6 and C_6H_{12}

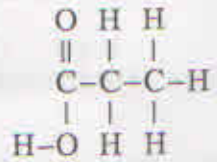
(D) C_2H_6 and C_4H_{10}

57. Which of the following correctly shows the structural formula of propanoic acid ?

(A)


(B)


(C)


(D)


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58. The ion of an element 'x' has 36 electrons distributed in different shells. Which of the following options correctly mentions the number of shells in an atom of element 'x' and its placement in the Modern Periodic Table ?

(A) No. of shells – 3, Placement in Modern Periodic Table – 3rd Period and 17th Group

(B) No. of shells – 3, Placement in Modern Periodic Table – 3rd Period and 18th Group

(C) No. of shells – 4, Placement in Modern Periodic Table – 4th Period and 17th Group

(D) No. of shells – 4, Placement in Modern Periodic Table – 4th Period and 18th Group

59. Five elements a, b, c, d and e have atomic numbers, 9, 11, 17, 12 and 13 respectively. The elements which belong to the same group of Modern Periodic Table of elements are :

(A) a and c

(B) b and d

(C) a and b

(D) d and e

60. The atomic number of the elements, Na, Mg, K and Ca are, 11, 12, 19 and 20 respectively. The element having the largest atomic radius is :

(A) K

(B) Na

(C) Ca

(D) Mg

61. The rough endoplasmic reticulum in a cell are the sites for the manufacture of

(A) Lipid

(B) Adenosine Triphosphate

(C) Enzymes

(D) Starch

62. Which of the following organelle is **not** present in the animal cell ?

(A) Lysosome

(B) Vacuole

(C) Endoplasmic reticulum

(D) Plastid

63. The roots of plants absorb water from the soil by the process of

(A) osmosis when the medium surrounding root cells is hypertonic

(B) diffusion when the medium surrounding root cells is isotonic

(C) osmosis when the medium surrounding root cells is isotonic

(D) osmosis when the medium surrounding root cells is hypotonic

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64. Which of the following is a connective tissue that helps in the repair of tissues and fills up the space inside the organ ?
(A) Areolar
(B) Adipose tissue
(C) Cartilage
(D) Tendon

65. A nail is inserted in the trunk of a tree a height of 150 cm from the ground level. After 3 years the nail will
(A) move sideways
(B) move upwards
(C) move downwards
(D) remains at the same position

66. Evergreen trees with needles and cones, grown for Chirstmas every year, belong to the class of plants known as
(A) bryophyta
(B) gymnosperms
(C) pteridophyta
(D) angiosperms

67. Read the following statements to identify the correct ones :
(i) Stomatal pores open when guard cells shrink
(ii) Villi in large intestines absorb water from undigested food
(iii) Haemoglobin has a very high affinity for oxygen
(iv) Lymph helps in clotting of blood in case of injury
(v) The oxygen produced during the process of photosynthesis is released by plants through the process of transpiration

The correct statements are :
(A) (ii) and (iii) only
(B) (iv) and (v) only
(C) (iii), (iv) and (v)
(D) (i), (ii) and (v)

68. Which structure (part) in human-female is equivalent to vas deferens in human male ?
(A) Oviduct (fallopian tube)
(B) Ovary
(C) Uterus
(D) Cervix

69. Which of the following organism would form a zygote in the process of producing its offspring ?
(A) Papaya
(B) Rhizopus
(C) Bryophyllum
(D) Potato

70. Fore-limbs of frogs, lizards, pigeons and whales have different shapes and functions. Frogs use fore-limbs for leaping, lizards for creeping, pigeons for flying while whales use them for swimming. However, skeletal parts of their fore-limbs are similar in structure and arrangement. From the given information it can be inferred that the fore-limbs of the four organisms are :
(A) homologous and therefore they have common ancestors
(B) analogous and therefore they have common ancestors
(C) homologous because they have not inherited them from same ancestors
(D) analogous because they do not have common ancestors

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71. Peptic ulcers are caused by

(A) helicobactor pylori which is a type of bacteria

(B) helicobactor pylori which is a type of virus

(C) staphylococci which is a type of bacteria

(D) Leishmania which is a type of bacteria

72. Which one of the following processes is **not** a part of the nitrogen cycle in nature ?

(A) Denitrification

(B) Ammonification

(C) Calcificatioin

(D) Nitrogen fixation

73. In a box type solar cooker, the heat trapped inside the box mainly comes from the

(A) visible spectrum of sunlight

(B) infrared radiation present in sunlight

(C) ultra-violet radiation present in sunlight

(D) red light present in spectrum of sunlight

74. In which set of organisms, all the four belong to tertiary level consumers ?

(A) Butterfly, Snake, Spider, Elephant

(B) Owl, Crocodile, Polar bear, Eagle

(C) Lion, Spider, Peacock, Zebra

(D) Python, Fish, Elephant, Whale

75. Which one of the following combinations of energy sources does **not** contain a fossil fuel ?

(A) wind, ocean, coal

(B) kerosene, wind, tide

(C) wood, sun, wind

(D) petrol, wood, sun

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