RESEARCH METHODOLOGY-SCIENCE (2018)

1. What is the next term in the following sequence ?

7, 11, 13, 17, 19, 23, 29, ...

(A) 37 (B) 35

(C) 31 (D) 33

2. Which of the following numbers is a perfect square ?

(A) 1022121 (B) 2042122

(C) 3063126 (D) 4083128

3. If 42 $\rightarrow$ 26, 71 $\rightarrow$ 78, 33 $\rightarrow$ 16, then 62 $\rightarrow$

(A) 68 (B) 54

(C) 38 (D) 39

4. Approximately how much blood flows per day through a normal human heart beating 70 times per minute, having a relaxed volume of 110 cc and compressed volume of 70 cc ?

(A) 7150 litres (B) 4000 litres

(C) 28000 litres (D) 11100 litres

5. Find the missing word : A, AB, _____, ABBABAAB

(A) AABB (B) ABAB

(C) ABBA (D) BAAB

6. How many digits are there in 3^{16} when it is expressed in the decimal form ?

(A) Three (B) Six

(C) Seven (D) Eight

7. The sum of the first n natural numbers with one of them missed is 42. What is the number that was missed ?

(A) 1 (B) 2

(C) 3 (D) 4

8. If N, E and T are distinct positive integers such that N × E × T = 2013, then which of the following is the maximum possible sum of N, E and T ?

(A) 39 (B) 2015

(C) 671 (D) 675

9. Two plane mirrors facing each other are kept at 60º to each other. A point is located on the angle bisector. The number of images of the point is :

(A) 6 (B) 3

(C) 5 (D) infinite

10. A 3 m long car goes past a 4 m long truck at rest on the road. The speed of the car is 7 m/s. The time taken to go past is :

(A) 4/7 s (B) 1 s

(C) 7/4 s (D) 10/7 s

11. The dimensions of a floor are 18 × 24. What is the smallest number of identical square tiles that will pave the entire floor without the need to break any tile ?

(A) 6 (B) 24

(C) 12 (D) 8

12. I bought a shirt at l0% discount and sold it to a friend at a loss of l0%. If the friend paid me Rs. 729.00 for the shirt, what was the undiscounted price of the shirt ?

(A) Rs. 900 (B) Rs. 800

(C) Rs. 1000 (D) Rs. 911.25

13. How many non-negative integers less than 10,000 are there such that the sum of the digits of the number is divisible by three ?

(A) 1112 (B) 2213

(C) 2223 (D) 3334

14. 20 teachers of a school either teach mathematics or physics. 12 of them teach mathematics while 4 teach both the subjects. Then the number of teachers teaching physics only is :

(A) 8 (B) 12

(C) 16 (D) None of these

15. Let A, B be the ends of the longest diagonal of the unit cube. The length of the shortest path from A to B along the surface is :

(A) $\sqrt{3}$ (B) $1+\sqrt{2}$

(C) $\sqrt{5}$ (D) 3

16. In an examination, a student scores 4 marks for every correct answer and loses 1 mark for every wrong answer. If he attempts in all 60 questions and secures 130 marks, the number of questions he attempts correctly, is :

(A) 35 (B) 38

(C) 40 (D) 42

17. It takes 2 hours for Tiwari and Deo to do a job. Tiwari and Hari take 3 hours to do the same job. Deo and Hari take 6 hours to do the same job. Which of the following statements is *incorrect* ?

(A) Tiwari alone can do the job in 3 hours

(B) Deo alone can do the job in 6 hours

(C) Hari does not work at all

(D) Hari is the fastest worker

18. If you count 21 letters in the English alphabet from the end and 20 letters from the beginning, which letter will appear exactly in the middle of the sequence thus formed ?

(A) M (B) L

(C) K (D) N

19. A train running at 36 km/h crosses a mark on the platform in 8 sec and takes 20 sec to cross the platform. What is the length of the platform ?

(A) 120 m (B) 280 m

(C) 40 m (D) 160 m

20. Water is slowly dripping out of a tiny hole at the bottom of a hollow metallic sphere initially full of water. Ignoring the water that has flowed away, the centre of mass of the system :

(A) remains fixed at the centre of the sphere

(B) moves down steadily as the amount of water decreases

(C) moves down for some time but eventually returns to the centre of the sphere

(D) moves down until half of the water is lost and then moves up

21. The missing number is :

3	6	8
5	8	4
4	7	?

(A) 6 (B) 7

(C) 8 (D) 9

22. Reena is twice as old as Sunita. Three years ago, she was three times as old as Sunita. How old is Reena now ?

(A) 6 years

(B) 7 years

(C) 12 years

(D) 8 years

23. A bicycle tube has a mean circumference of 200 cm and a circular cross-section of diameter 6 cm. What is the approximate volume of water (in cc) required to completely fill the tube, assuming that it does not expand ?

(A) 600 π (B) 1200 π

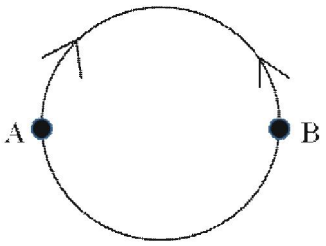
(C) 3600 π (D) 1800 π

24. Six persons P, Q, R, S, T and U are standing in a circle. Q is between S and R. P is between T and R. U is to the right of S. Who is between P and U ?

(A) Q (B) R

(C) T (D) S

25.



Two ants, initially at diametrically opposite points A and B on a circular ring of radius R, start crawling towards each other. The speed of the one at A is half of that of the one at B. The point at which they meet is at a straight line distance of :

(A) R from A

(B) $\frac{3R}{2}$ from A

(C) R from B

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

26. A person completely under sea water tracks the Sun. Compared to an observer above water, which of the following observations would be made by the underwater observer ?

(A) Neither the time of sunrise or sunset nor the angular span of the horizon changes.

(B) Sunrise is delayed, sunset is advanced, but there is no change in the angular span of the horizon.

(C) Sunrise and sunset times remain unchanged, but the angular span of the horizon shrinks.

(D) The duration of the day and the angular span of the horizon, both decrease.

27. The number of boys in a class is three times the number of girls. Which one of the following numbers cannot represent the total number of children in the class ?

(A) 48

(B) 42

(C) 44

(D) 40

28. Two coconuts have spherical space inside their kernels, with the first having an inner diameter twice that of the other. The larger one is half filled with liquid, while the smaller is completely filled. Which of the following statements is *correct* ?

(A) The larger coconut contains 4 times the liquid in the smaller one.

(B) The larger coconut contains twice the liquid in the smaller one.

(C) The coconuts contain equal volumes of liquid.

(D) The smaller coconut contains twice the liquid in the larger one.

29. A tiger usually stalks its prey from a direction that is upwind of the prey. The reason for this is :

(A) the wind aids its final burst for killing the prey

(B) the wind carries the scent of the prey to the tiger and helps the tiger locate the prey easily

(C) the upwind area usually has denser vegetation and better camouflage

(D) the upwind location aids the tiger by not letting its smell reach the prey

30. A cellphone tower radiates 1W power while the handset transmitter radiates 0.1 mW power. The correct comparison of the radiation energy received by your head from a tower 100 m away (E_1) and that from a handset held to your ear (E_2) is :

(A) $E_1 >> E_2$

(B) $E_2 >> E_1$

(C) $E_1 = E_2$ for communication to be established

(D) insufficient data even for a rough comparison

31. The pitch of a spring is 5 mm. The diameter of the spring is 1 cm. The spring spins about its axis with a speed of 2 rotations/s. The spring appears to be moving parallel to its axis with a speed of :

(A) 1 mm/s (B) 5 mm/s

(C) 6 mm/s (D) 10 mm/s

32. A boy holds one end of a rope of length l and the other end is fixed to a thin pole of radius r ($l >> r$). Keeping the rope taut, the boy goes around the pole causing the rope to get wound around the pole. Each round takes 10 s. What is the speed (in units of s^{-1}) with which the boy approaches the pole ?

(A) $\frac{\pi r}{5}$ (B) $\frac{\pi l}{5}$

(C) $20\pi(r+l)$ (D) $\frac{20\pi(r-l)}{5}$

33. A rectangular flask of length 11 cm, width 8 cm and height 20 cm has water filled up to height 5 cm. If 21 spherical marbles of radius 1 cm each are dropped in the flask, what would be the rise in water level ?

(A) 8.8 cm (B) 10 cm

(C) 1 cm (D) 0 cm

34. Deepak starts walking straight towards east. After walking 75 metres, he turns to the left and walks 25 metres straight. Again he turns to the left, walks a distance of 40 metres straight, again he turns to the left and walks a distance of 25 metres. How far is he from the starting point ?

(A) 25 m (B) 50 m

(C) 115 m (D) 35 m

35. A leaf appears green in daylight. If this leaf were observed in red light, what colour would it appear to have ?

(A) green (B) black-brown

(C) red (D) blue

36. The sum of two numbers is equal to sum of square of 11 and cube of 9. The larger number is $(5)^2$ less than square of 25. What is the value of the sum of twice of 24 per cent of the smaller number and half of the larger number ?

(A) 415 (B) 400

(C) 410 (D) 420

37. For which one of the following statements is the converse NOT true ?

(A) If a patient dies even with excellent medical care, he likely had terminal illness.

(B) If a person gets employed, he has good qualifications.

(C) If an integer is even, it is divisible by two.

(D) If an integer is odd, it is not divisible by two.

38. How many numbers from 1 to 100 are there each of which is not only exactly divisible by 4 but also has 4 as a digit ?

(A) 21 (B) 10

(C) 20 (D) 7

39. If a plant with green leaves is kept in a dark room with only green light ON, which one of the following would we observe ?

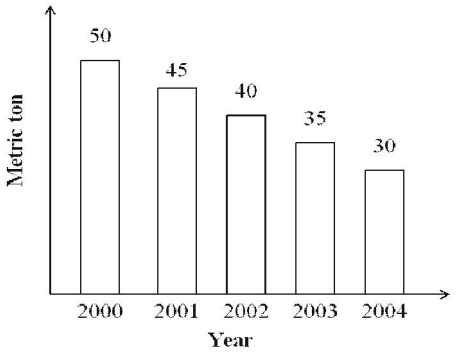
(A) The plant appears brighter than the surroundings

(B) The plant appears darker than the surroundings

(C) We cannot distinguish the plant from the surroundings

(D) It will have above normal photosynthetic activity

40. Wheat production of a country over a number of years is shown. Which year recorded highest per cent reduction in production over the previous year ?



(A) 2001

(B) 2002

(C) 2003

(D) 2004

41. L is the tallest and eldest of a group of five people K, L, M, N and P. M is elder to N and shorter than K. M and P are of same age and P is taller than K. N and K are of same height and K is younger to P. Which of the following inferences is certain ?

(A) P is taller than M

(B) N is the youngest

(C) N is elder to P

(D) N is elder to K

42. In a fast moving car with open windows, the driver feels a continuous incoming breeze. The pressure inside the car, however, does not keep increasing because :

(A) Air coming in from the front window goes out from the rear.

(B) Air comes in as well as goes out through every window but the driver only feels the incoming one.

(C) No air actually comes in and the feeling of breeze is an illusion.

(D) Cool air reduces the temperature therefore the pressure does not increase.

43. A tall metal cylinder is filled end-to-end with n snugly fitting spherical wax balls of diameter d. If the balls melt completely, the volume fraction occupied by the melted wax is :

(A) independent of both d and n

(B) dependent on both d and n

(C) independent of d, but dependent on n

(D) dependent on d, but independent of n

44. In each of the following groups of words is a hidden number, based on which you should arrange them in descending order. Pick the *correct* answer :

E. Papers I Xeroxed
F. Wi-Fi veteran
G. Yourself ourselves
H. Breaks even

(A) E, F, G, H
(B) E, G, F, H
(C) H, F, G, E
(D) H, E, F, G

45. Four circles of unit radius each are drawn such that each one touches two others and their centres lie on the vertices of a square. The area of the region enclosed between the circles is :

(A) π-1
(B) π-2
(C) 4-π
(D) 3-π

46. A film projector and microscope give equal magnification. But a film projector is not used to see living cells because :

(A) a living cell cannot be placed in a film projector.
(B) the viewer's eye is close to a microscope whereas it is far away from the projector's screen.
(C) a microscope produces a virtual image whereas a projector produces a real image.
(D) a microscope has greater resolving power than a projector.

47. Comparing numerical values, which of the following is different from the rest ?

(A) The ratio of the circumference of a circle to its diameter.
(B) The sum of the three angles of a plane triangle expressed in radians.
(C) 22/7.
(D) The net volume of a hemisphere of unit radius, and a cone of unit radius and unit height.

48. Seeds when soaked in water gain about 20% by weight and 10% by volume. By what factor does the density increase ?

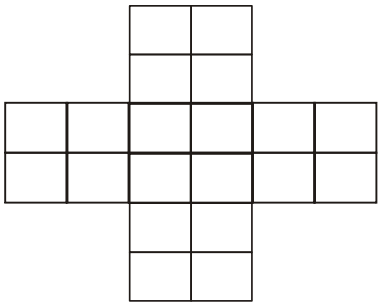
(A) 1.20

(B) 1.10

(C) 1.11

(D) 1.09

49.



The number of squares in the above figure is :

(A) 30 (B) 29

(C) 25 (D) 20

50. Five persons A, B, C, D, and E are sitting in a row with C in the middle of the group. If D is at an extreme end and there are at least two persons between B and E, then which of the following statements is *incorrect* ?

(A) E can be on extreme left

(B) E can be on extreme right

(C) A cannot be on extreme left

(D) A is always a neighbour of B or D

ENERGY & ENVIRONMENT STUDIES

51. The energy possessed by a body by virtue of random motion of the molecules within it is called :

(A) Kinetic energy (B) Chemical energy

(C) Heat energy (D) Mechanical energy

52. What is the smallest practical unit of energy ?

(A) Watt (B) Electron volt

(C) Kilowatt (D) Calorie

53. Coal, oil, natural gas and uranium are which type of energy sources ?

(A) Primary energy sources (B) Secondary energy sources

(C) Supplementary energy sources (D) Tertiary energy sources

54. The ratio of the energy fed back by a material to the energy received from the environment is known as :

(A) Energy production ratio (B) Energy consumption ratio

(C) Energy yield ratio (D) Energy input ratio

55. Thermal insulation is an example of :

(A) Primary energy sources (B) Renewable energy sources

(C) Supplementary energy sources (D) None of these

56. The word 'Energy' was derived from the Greek word :

(A) Energeia (B) Energetics

(C) Energia (D) None of these

57. In developed countries, most of the energy requirement is met by :

(A) Commercial energy sources

(B) Non-commercial energy sources

(C) Non-conventional energy sources

(D) None of the above

58. The photovoltaic effect was first demonstrated by :

(A) Edmond Becquerel (B) James Prescott Joule

(C) Albert Einstein (D) None of these

59. Renewable energy resources generate :

(A) More energy than fossil fuels

(B) Same amount of energy as fossil fuels

(C) Less energy than fossil fuels

(D) Virtually no energy

60. Which of the following is a renewable energy ?

(A) Diesel

(B) Bio-diesel

(C) Natural gas from gas hydrates

(D) Synthetic diesel obtained from coal

61. Renewable sources of energy are :

(A) Intermittent (B) Dilute

(C) Expensive to concentrate (D) All of these

62. An energy policy does *not* include :

(A) Target energy consumption reduction

(B) Time period for reduction

(C) Declaration of top management commitment

(D) Future production projection

63. A reaction that takes place in a nuclear reactor, which converts nuclear energy into electrical energy, is called :

(A) Nuclear fusion reaction

(B) Uncontrolled Nuclear fission reaction

(C) Controlled Nuclear fusion reaction

(D) Controlled Nuclear fission reaction

64. Which of the following are common moderators that slow down neutrons released in a nuclear fission reaction ?

(A) Ordinary stone and soft soil

(B) Heavy water and graphite

(C) Filtered water and stone

(D) Hard soil and water

65. If each fission of $_{92}U^{235}$ releases 200 MeV, how many fissions must occur per second to produce 1 kW of power ?

(A) $3.125 * 10^{13}$ (B) $3.125 * 10^{14}$

(C) $3.125 * 10^{15}$ (D) $3.125 * 10^{16}$

66. What does ETC stand for with respect to solar energy ?

(A) Electricity Transmitting Collector

(B) Evacuated Tube Collector

(C) Electricity Temperature Converter

(D) Electrons Transport Carrier

67. What does SPV stand for with respect to solar energy ?

(A) Solar photovoltaic (B) Solid platevoltaic

(C) Solar platevoids (D) None of these

68. Which of the following appliances use solar photovoltaic technology ?

(A) Solar lantern (B) Biogas plant

(C) Solar water heater (D) Solar air heater

69. A typical insulation material in a solar collector is :

(A) Fibre glass (B) Cotton

(C) Glasswool (D) None of these

70. At present, the maximum efficiency of a commercial solar photovoltaic cell is :

(A) 3% (B) 12% - 30%

(C) 50% - 65% (D) 65% - 70%

71. Pyranometer is an instrument used for measuring the :

(A) Temperature of a solar photovoltaic cell

(B) Solar irradiance of a solar photovoltaic cell

(C) Wind speed of a solar photovoltaic cell

(D) Efficiency of a solar photovoltaic cell

72. Which one of the following is *not* related to solar photovoltaic systems ?

(A) Cooking (B) Lighting

(C) Irrigation (D) Generation of electricity

73. When sunlight falls on a photovoltaic panel, some particles gain enough energy to produce electric current. These particles are called :

(A) Electrons (B) Protons

(C) Neutrons (D) None of these

74. Which one of the following is *not* an application of hydrogen energy ?

(A) Fuel cell (B) Generator set

(C) Running a two wheeler (D) Producing biofuel

75. The production of hydrogen using bio-photolysis method requires the use of green algae in an :

(A) Aerobic environment

(B) Anaerobic environment free from nitrogen

(C) Anaerobic environment containing Sulphur

(D) None of the above

76. Hydrogen has a calorific value of :

(A) 150 kJ/g (B) 200 kJ/g

(C) 500 kJ/g (D) 1000 kJ/g

77. Global monitoring of food and forestry can be detected by :

(A) LANDSAT MSS

(B) LANDSAT Thermatric Mapper

(C) AVHRR

(D) All of the above

78. Features of coastal water and land mass can be detected by :

(A) NOAA (B) IRS

(C) LISS-I data (D) All of these

79. GIS Softwares can be split into which of the functional group ?

(A) Data input and verification

(B) Data output and presentation

(C) Data transformation

(D) All of the above

80. The country suffered during 1980 because of acid rain is :

(A) India (B) Sweden

(C) Los Angeles (D) London

81. Which of the following can affect the performance of catalytic converter ?

(A) Pb (B) Benzene

(C) Cu (D) Cd

82. The most toxic form of Chromium is :

(A) Cr(VI) (B) Cr(III)

(C) Cr^0 (D) All of these

83. Flameless or Cold Vapour Atomic Absorption is a special technique for the analysis of :

(A) Cd (B) Pb

(C) Hg (D) Se

84. In Gas Chromatography/Mass Spectrometry, Mass Spectrometry requires :

(A) Large amount of samples

(B) Low vacuum

(C) High vacuum

(D) None of the above

85. The Environmental Impact Statement (EIS) is an outgrowth of :

(A) President Ronald Reagan's Executive Order 12291

(B) The National Environmental Policy Act

(C) The Comprehensive Environmental Response, Compensation and Liability Act

(D) The 1976 Resource Conservation and Recovery Act

86. Normally, an environmental impact statement is prepared :

(A) When persons or businesses impacted by the proposed activity request an EIS

(B) For every proposed federal legislation or other major federal action that can significantly affect the quality of the human environment

(C) When, after a careful review of the proposed activity, a government appointed panel of environmental scientists deems it necessary

(D) Whenever existing federal legislation fails establish environmental guidelines and pollution-control standards for a proposed federal activity

87. A geological complication that interfered with the construction of the Panama Canal was :

(A) The presence of quick clays

(B) The presence of numerous solution cavities and sinkholes

(C) Volcanic eruptions

(D) Landslides

88. The step carried out at early stage of EIA planning is called :

(A) Preliminary Assessment

(B) Detailed Assessment

(C) Environmental Statement

(D) All of the above

89. If you are standing still at the equator, how fast are you rotating around the centre of the Earth ?

(A) 0 miles per hour (0 km/hr.)

(B) 11 miles per hour (18 km/hr.)

(C) 1100 miles per hour (1770 km/hr.)

(D) 110 miles per hour (180 km/hr.)

90. A course-grained clastic sedimentary rock having fragments above 2 mm in diameter is :

(A) Sandstone (B) Shale

(C) Rock salt (D) Conglomerate

91. Mid-ocean ridges represent regions where lithospheric plates are :

(A) Sliding past each other (B) Spreading apart

(C) Colliding (D) Not in motion

92. Who is regarded as Father of biodiversity ?

(A) Myers (B) Mishra

(C) Odum (D) Wilson

93. How many species are estimated to have vanished from the world's tropical forests in the past 20 years ?

(A) 500 (B) 10 thousand

(C) 1 million (D) 1000

94. There are many different types of animals and plants, and they live in many different type of environments. What word is used to describe this idea ?

(A) Multiplicity (B) Biodiversity

(C) Socio-economics (D) Evolution

95. As per Ministry of Environment and Forest, the number of biosphere reserve in India is :

(A) 3 (B) 13

(C) 23 (D) 10

96. When some work is done, then there will be some waste heat, this is in accordance with :

(A) 1st law of thermodynamics

(B) 2nd law of thermodynamics

(C) 3rd law of thermodynamics

(D) Entropy

97. Flame photometer can be used to analyze :

(A) Na (B) F

(C) Cr (D) Pb

98. When comparing the value of BOD and COD of a given sample :

(A) BOD will be high

(B) COD will be high

(C) Both are equal

(D) Both are independent

99. Albedo means :

(A) The ratio of the amount of solar radiation (or visible range of radiation) reflected by a surface

(B) The amount incident on it, also expressed as a percentage

(C) Both (A) & (B)

(D) None of the above

100. .....is a formation which contains water but cannot transmit it rapidly enough to furnish a significant supply to a well or spring.

(A) Alluvium (B) Alluvival Fans

(C) Aquiclude (D) Albedo