ENTRANCE EXAMINATION FOR ADMISSION, MAY 2011.

M.Sc. (COMPUTATIONAL BIOLOGY)

COURSE CODE : 310

Register Number :

Signature of the Invigilator
(with date)

COURSE CODE : 310

Time : 2 Hours

Max : 400 Marks

Instructions to Candidates :

1. Write your Register Number within the box provided on the top of this page and fill in the page 1 of the answer sheet using pen.

2. Do not write your name anywhere in this booklet or answer sheet. Violation of this entails disqualification.

3. Read each question carefully and shade the relevant answer (A) or (B) or (C) or (D) or (E) in the relevant box of the ANSWER SHEET using HB pencil.

4. Avoid blind guessing. A wrong answer will fetch you −1 mark and the correct answer will fetch 4 marks.

5. Do not write anything in the question paper. Use the white sheets attached at the end for rough works.

6. Do not open the question paper until the start signal is given.

7. Do not attempt to answer after stop signal is given. Any such attempt will disqualify your candidature.

8. On stop signal, keep the question paper and the answer sheet on your table and wait for the invigilator to collect them.

9. Use of Calculators, Tables, etc. are prohibited.

1. What is the distance in space between the points with coordinates (-3,6,7) and (2, -1,4)?

    (A) 4.36   (B) 5.92   (C) 7.91   (D) 9.11

2. A line has parametric equations x=5+t and y=7+t, where 't' is the parameter. The slope of the line is

    (A) 5/7   (B) 1   (C) 7+t/5+t   (D) 7/5

3. If the measure of one angle of a rhombus is 60°, then the ratio of the length of its longer diagonal to the length of its shorter diagonal is

   (A) 2   (B) 3   (C) $\sqrt{2}$ (D) $\sqrt{3/2}$

4.

Time t (years)	0	1	2	5
Value $v(t)$ (dollars)	15,000	13,000	10,900	3,000

When purchased, an automobile is valued at $15,000. It value depreciates at the rate shown in the table above. Based on a least squares linear regression what is the value, to the nearest hundred dollars of the automobile when t=4

    (A) $5,400   (B) $5,500   (C) $5,600   (D) $6,400

5.
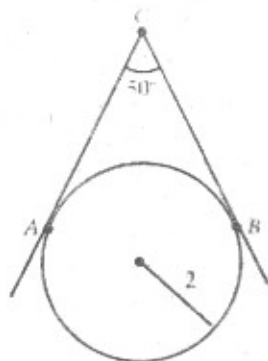
In the figure above, 2 lines are tangent to a circle of radius 2 at points A and B. What is the length segment AB (not shown)?

    (A) 1.37   (B) 1.69   (C) 3.06   (D) 3.63

6. A band wants to distribute its music on compact disc (CDs). The equipment to produce the CDs cost $250 and blank CDs cost $5.90 for a package of 10. Which of the following represents the total cost, in dollars, to produce n CDs where n is a multiple of 10?

    (A) $(250+0.59)n$ (B) $250+0.59n$ (C) $(250+5.90)n$ (D) $250+5.90n$

7. What is the range of the function defined by $f(x) = 1/x + 2$?

(A) All real numbers

(B) All real numbers except -1/2

(C) All real numbers except 0

(D) All real numbers except 2

8. A number n is increased by 8. If the cube root of that result equals -0.5, what is the value of n?

(A) −15.625   (B) − 8.794   (C) −8.125   (D) −7.875

9.
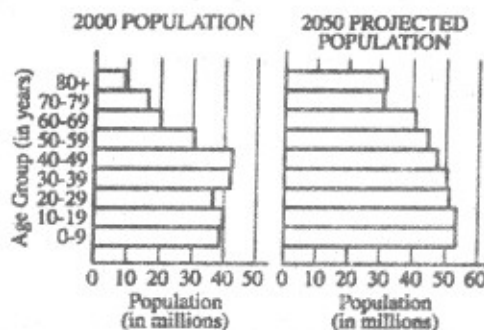
The graphs above show India's Census bureau population figures for the year 2000 for various age groups, together with projections for the year 2050. Of the following age groups, for which is the projected percent increase in population from 2000 to 2050 greatest?

(A) 30-39   (B) 40-49   (C) 50-59   (D) 60-69

10. If $f(x) = x^4 - 3x^3 - 9x^2 + 4$, for how many real numbers k does $f(k) = 2$?

(A) None   (B) One   (C) Four   (D) Six

11. If line l is the perpendicular bisector of the line segment with end points (2,0) and (0,-2) what is the slope of line l ?

(A) 2   (B) 1   (C) 0   (D) -1

12. What is the measure of one of the larger angles of a parallelogram in the xy-plane that has vertices with coordinates (2,1),(5,1), (3,5), and (6,5)?

(A) 93.4°   (B) 96.8°   (C) 104.0°   (D) 108.3°

13. If (x-2) is a factor of $x^3 + kx^2 + 12x - 8$, then k=
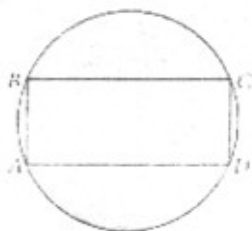
(A) -6   (B) -3   (C) 2   (D) 3

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14.

Note: Figure not drawn to scale.

In the figure shown above △ABC has a right angle at C, If the length of side AC is 10 and the measure ∠BAC is 22°, what is the length of side BC?

(A) 3.7   (B) 4.0   (C) 5.8   (D) 6.8

15.

Rectangle ABCD is inscribed in the circle shown above, if the length of side AB is 5 and the length of side BC is 12, what is the area of the shaded region?

(A) 40.8   (B) 53.1   (C) 72.7   (D) 78.5

16.

In the figure above $\overline{AB}$ and $\overline{CD}$ are parallel. What is x in terms of y and z?

(A) y+z   (B) 2y+z   (C) 2y-z   (D) 180-y-z

17. For some real number t, the first three terms of an arithmetic sequence are 2t, 5t-1 and 6t+2. What is the numerical value of the fourth term?

(A) 4   (B) 8   (C) 10   (D) 19

18. If $f(x)= x+3$ and $g(x) = (x^2-9)/x-3$, which of the following statement are true about the graphs of f and g in the x-y plane?

I. The graphs are exactly the same

II. The graphs are the same except when x=3

III. The graphs have an infinite number of points in common

(A) I only   (B) II only   (C) III only   (D) II and III

19. The diameter and height of a right circular cylinder are equal. If the volume of the cylinder is 2, what is the height of the cylinder?
   (A)   1.37   (B)   1.08   (C)   0.86   (D)   0.80

20. If $\log_c a = x$, which of the following must be true?
   (A) $a^c = x$ (B) $a^x = c$ (C) $c^a = x$ (D) $c^x = a$

21. Twenty students have each sampled one or more of three kind's candy bars that a school store sells. If 3 students have sampled all three kinds, and 5 have sampled exactly two kinds, how many of these students have sampled only one kind?
   (A)   8   (B)   12   (C)   15   (D)   17

22. If $f(x)=(3x+12)/(2x-12)$ what value does $f(x)$ approach as x gets infinitely larger?
   (A)   -6   (B)   -3/2   (C)   -1   (D)   3/2

23. The front, side, and bottom faces of a rectangular solid have areas of 24 square centimeters, 8 square centimeters, and 3 square centimeters, respectively. What is the volume of the solid, in cubic centimeters?
   (A)   24   (B)   96   (C)   192   (D)   288

24. The number of hours of daylight, d, in Hartsville can be modeled by d= 35/3+7/3 sin $(2\pi$ t/365), where t is the number of days after March 21. The day with the greatest number of hours of daylight has how many more daylight hours than May 1? (March and May have 31 days each. April and June have 30 days each.)
   (A)   0.8 hr   (B)   1.5 hr   (C)   2.3 hr   (D)   3.0 hr

25. If a and b are real numbers, $i^2 = -1$ and (a+b)+5i=9+ai, what is the value of b?
   (A)   4   (B)   5   (C)   9   (D)   4+5i

26. Which of the following may transmit the energy from one point to another?
   I.   Electromagnetic radiation
   II.   Sound waves
   III. Convection currents
   (A)   I only   (B)   III only
   (C)   I and II only   (D)   I, II and III only

27. A pendulum of length l with a bob of mass m is oscillating with a small amplitude. Which of the following changes in the pendulum would double its period?
   (A)   Doubling the mass m of the bob
   (B)   Doubling the initial force used to set the pendulum in motion
   (C)   Doubling the amplitude of the pendulum swing
   (D)   Quadrupling the mass m of the bob

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28. In a given process 12 joules of heat is added to an ideal gas and the gas does 8 joules of work. Which of the following is true about the internal energy of the gas during this process?

(A) It has increased by 20 joules   (B) It has increased by 4 joules

(C) It has not changed   (D) It has decreased by 20 joules

29. When a vector of magnitude 6 units is added to a vector of magnitude 8 units, the magnitude of the resultant vector will be

(A) Exactly 2 units

(B) Exactly 10 units

(C) Exactly 14 units

(D) 0 units, 10 units, or some value in between

(E) 2 units, 14 units, or some value in between

Question 30 relates to a point charge $+Q$ fixed in position as shown below. 5 point charges near the charge and in the plane of the page are shown.
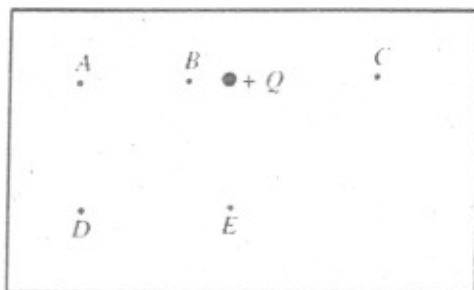
30. At which point will an electron experience a force directed toward the top of the page?

31. A charged insulator and an uncharged metal

(A) exert no electric field on each other

(B) repel each other electrically

(C) attract each other electrically

(D) attract or repel each other depending whether charge is positive or negative.

32. An experiment is performed to measure the specific heat of copper. A lump of copper is heated in an oven, then dropped into a beaker of water. To calculate the specific heat of copper, the experimenter must know or measure all the values of the quantities below EXCEPT the

(A) Mass of water

(B) Original temperatures of copper and water

(C) Final(equilibrium) temperature of copper and water

(D) Time taken to achieve equilibrium after the copper is dropped into the water

(E) Specific heat of water

33.
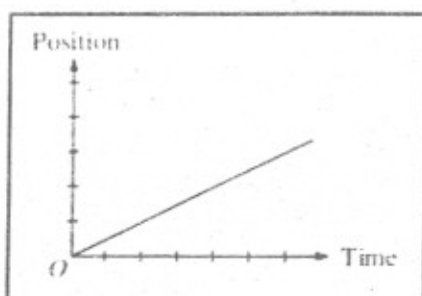
The graph of position versus time for an object moving along a straight line is given above. During the time shown on the graph the speed and acceleration of the object will have which of the following characteristics?

	SPEED	ACCELERATION
(A)	Increasing	Increasing
(B)	Increasing	Constant but not zero
(C)	Constant but not zero	Increasing
(D)	Constant but not zero	Zero
(E)	Zero	Constant but not zero

34.

Three energy levels of an atom are shown above. Atoms in the $n=2$ state can spontaneously emit photons having which of the following energies?

(A)   4eV only

(B)   7eV only

(C)   3eV and 4eV only

(D)   3eV and 7eV only

(E)   3eV, 4eV and 7eV

35.   The earth has a radius of 6000 km. A satellite orbits the earth at a distance of 12,800 km from the centre of the earth. If the weight of the satellite on earth is 1000 kiloNewtons, the gravitational force on the satellite in orbit is

(A)   11 kN   (B)   25 kN   (C)   50 kN   (D)   200 kN

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36. Which of the following is true of the magnetic field produced by a current in a long straight wire?

   (A) The field is uniform
   (B) The field increases in strength as distance from the wire increases
   (C) The field lines are directed parallel to the wire but opposite to the direction of current.
   (D) The field lines are directed radially outward from the wire
   (E) The field lines form circles about the wire.

Questions 37 and 38
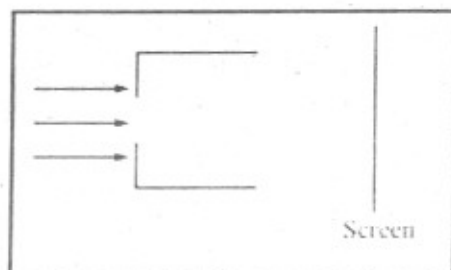
A beam of light is incident on a rectangular opening in the front of a box, as shown in the side view above. The back of the box is open. After passing through the box the light is incident on a screen. The following devices are placed in front of the slit:

   (A) A convex lens
   (B) A concave lens
   (C) A thick sheet of glass
   (D) An opaque card with a very narrow slit
   (E) A prism with vertex pointing downward.

37. Which device could produce a tiny spot of light on the screen?

38. Which device could produce a diffraction pattern consisting of a central bright fringe with parallel secondary fringes that decrease in intensity with increasing distance from the centre of the screen?

39. A 5 kg block is suspended by a cord from the ceiling, as shown below. The force exerted on the block by the cord is most nearly
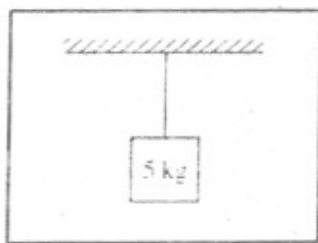
   (A) Zero   (B) 25 N   (C) 50 N   (D) 100 N
   (E) 200 N

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Question 40 & 41 relate to the following circuit.
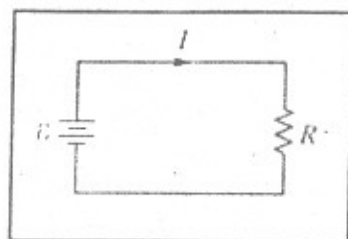
A single resistor R is connected to a battery as shown above. The current is I and the power dissipated as heat is P. the circuit is changed by doubling the e.m.f ε of the battery while R is kept constant.

40. After the change the current is

(A) 4I (B) I/2 (C) I (D) 2I

41. After the change the power dissipated in R is

(A) P/4 (B) P/2 (C) P (D) 2P

(E) 4P

Question 42 & 43

A piece of chalk is thrown vertically upward and caught during its descent at the same height from which it was thrown. Position is measured from location of the chalk when it left the hand. The positive direction for position, velocity and acceleration is upward.

42. What are the signs of position, velocity and acceleration during ascending part of the trajectory?

	POSITION	VELOCITY	ACCELERATION
(A)	Positive	Positive	Positive
(B)	Positive	Positive	Negative
(C)	Positive	Negative	Negative
(D)	Negative	Positive	Negative
(E)	Negative	Negative	Negative

43. What are the signs of position, velocity and acceleration during descending part of the trajectory?

	POSITION	VELOCITY	ACCELERATION
(A)	Positive	Positive	Positive
(B)	Positive	Positive	Negative
(C)	Positive	Negative	Negative
(D)	Negative	Positive	Negative
(E)	Negative	Negative	Negative

Top View

44.
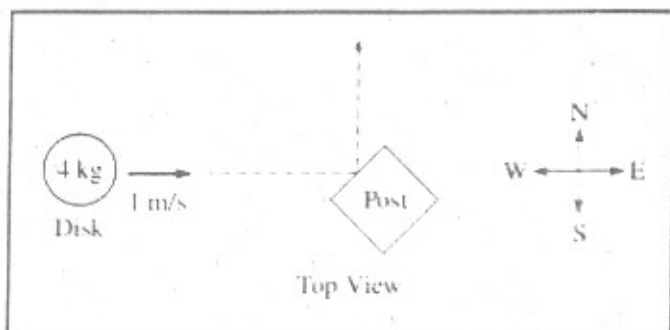
A four kg disc slides over level ice towards the east at a velocity of 1m/s, as shown above. The disc strikes a post and rebounds toward the north at the same speed. The change in the magnitude of the eastward component of the momentum of the disc is

(A)   -4 kg m/s   (B)   -1 kg m/s   (C)   0 kg m/s   (D)   1 kg m/s

(E)   4 kg m/s

Questions 45 and 46

Ocean waves are moving toward a beach with a speed of 10m/s and a frequency of 2 per second.

45.   The wavelength of the waves is most nearly

(A)   0.2 m   (B)   0.5 m   (C)   5 m   (D)   10 m

(E)   20m

46.   The waves are observed by a child sitting in row boat offshore. Which of the following properties of the waves seen by the child would be greater when the boat is moving away from the beach than when the boat is stationary with respect to the beach.

I.   Speed of the waves with respect to the boat

II.   Frequency at which the boat encounter successive wave crests

III.   Distance between adjacent wave crests

(A)   I only   (B)   III only

(C)   I and II only   (D)   II and III only

(E)   I, II and III

47. Which of the following graphs best represents, the kinetic energy K of an elementary particle as a function of its speed v where c is the speed of light?
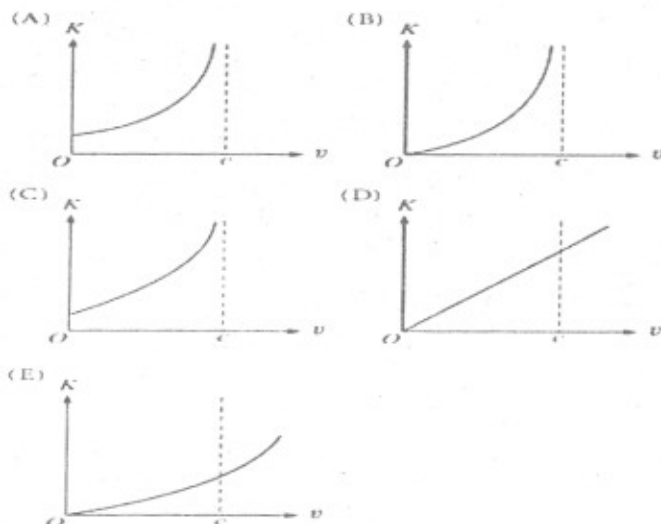
48.
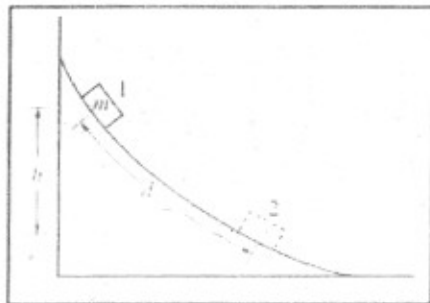
A box of mass m is released from rest at position 1 on the frictionless curved track as shown above. It slides a distance d along the track in time t to reach position 2, dropping a vertical distance h. Let v and a be the instantaneous speed and instantaneous acceleration respectively of the box at position 2. Which of the following equations is valid for this situation.

(A) $h=vt$ (B) $h=1/2gt^2$ (C) $d=i/2at^2$ (D) $mgh=1/2mv^2$

49.

Q_1 P Q_2

A known positive charge is located at point P as shown above, between two unknown charges Q_1 and Q_2. P is closer to Q_2 than Q_1. If the net electric force acting on the charge at P is zero. It may be correctly concluded that

(A) Both Q_1 and Q_2 are positive

(B) Both Q_1 and Q_2 are negative

(C) Q_1 and Q_2 have opposite signs

(D) Q_1 and Q_2 have the same sign but magnitude of Q_2 is greater than Q_1

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50. The half life of one isotope of Radium is about 1600 years. In a given sample of this isotope, 15/16 of the radium atoms will decay in a time most nearly equal to

    (A) 1000 years   (B) 1,500 years   (C) 1,600 years   (D) 3,200 years

51. Which among these is weakly acidic?

    (A) 0.1M HCl

    (C) 0.1M $HC_2H_2O_2$

    (B) 0.1M KOH

    (D) 0.1M CH_3OH

52. Which among these has the highest pH?

    (A) 0.1M HCl

    (C) 0.1M $HC_2H_2O_2$

    (B) 0.1M KOH

    (D) 0.1M CH_3OH

53. Which among these reacts with equal volume of 0.05M $Ba(OH)_2$ to form a solution with pH = 7?

    (A) 0.1M HCl

    (C) 0.1M $HC_2H_2O_2$

    (B) 0.1M KOH

    (D) 0.1M CH_3OH

54. Which among these has the following configuration in the ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^4$?

    (A) Ar   (B) O   (C) S   (D) Ti

55. Which among these has the following has the same number of electrons as Ca^{2+}?

    (A) Ar   (B) O   (C) S   (D) Ti

56. Which among these has the following has electrons in f orbitals?

    (A) O   (B) S   (C) Ti   (D) Eu

57. Which among these has the following is the LEAST chemically reactive?

   (A) Ar   (B) O   (C) S   (D) Ti

58. A thermometer placed in a test tube containing a melted pure substance. As slow cooling occurs, the thermometer is read at regular intervals well until after the sample has solidified. Which of the following types of graphs is obtained by plotting temperature versus time for this experiment?

(A)

Temperature / Time

(B)

Temperature / Time

(C)

Temperature / Time

(D)

Temperature / Time

(E)

Temperature / Time
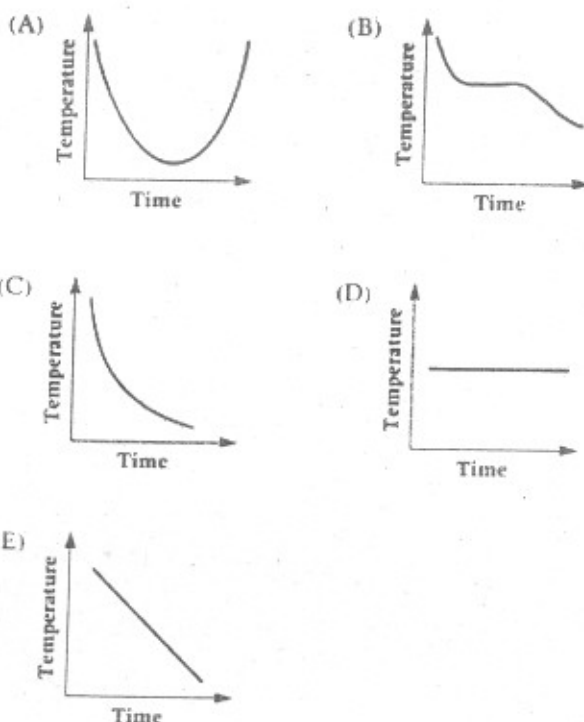
(A) As depicted in plot A
(B) As depicted in plot B
(C) As depicted in plot D
(D) As depicted in plot E

59. All of the following can act as Bronsted-Lowry acids in aqueous solution EXCEPT
(A) HI
(B) NH^{4+}
(C) HCO^{3-}
(D) H_2S
(E) NH

60. From their electronic configurations one can predict that the geometric configurations for which of the following is NOT correct
(A) PF_3 is triangular planar
(B) CF_4 is tetrahedral
(C) $CHCl_3$ is irregular tetrahedrom
(D) OF_2 bent(v-shaped)
(E) HF linear

61. The combustion of propane C_3H_8 proceeds according to the equation below. How many grams of water will be formed in the complete combustion of 44.0g of propane?
$$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$$
(A) 4.5 g
(B) 18 g
(C) 44.0 g
(D) 72.0 g
(E) 176 g

13

62.
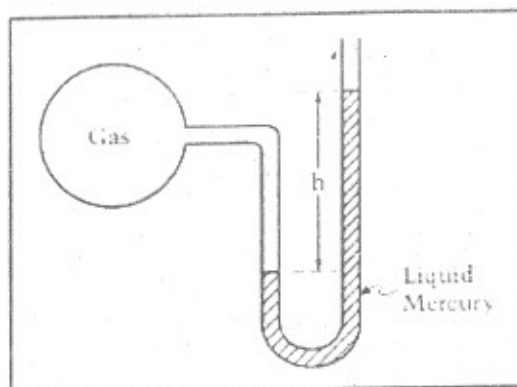
The bulb of the open end manometer shown above contains a gas. True statements about this system include which of the following?

I. Only atmospheric pressure is exerted on the exposed mercury surface in the right side of the tube

II. The gas pressure is greater than atmospheric pressure

III. The difference in the height h, of mercury levels is equal to the pressure of the gas.

(A) II only (B) III only (C) I and II only (D) I and III only

(E) I, II and III

63. The hydrogen ion concentration of a solution prepared by diluting 50ml of 0.1M HNO_3 with water to 500 ml is

(A) 0.001M (B) 0.005M (C) 0.01M (D) 0.05M

64. All of the following statements about carbon dioxide are true EXCEPT

(A) It can be prepared by action of acid on limestone

(B) It is used to extinguish fires

(C) It dissolves in water at room temperature

(D) It is less dense than air at given temperature and pressure

65. What is the minimum number of moles of $PbSO_4$ that must be used to prepare 1 liter of saturated $PbSO_4$ solution at 25°C?(K_{sp} at 25°C for $PbSO_4 = 1 \times 10^{-8}$)?

(A) 1×10^{-16} mol (B) 1×10^{-8} mol

(C) 1×10^{-4} mol (D) 1×10^{-2} mol

(E) 1×10^{-1} mol

Question 66- 68 refer to the following ionic species

(A) X^+ (B) X^{3+} (C) XO_3^{2-} (D) XO_4^{3-}

66. A type of ion found in sodium acetate

67. A type of ion found in aluminium oxide

68. A type of ion found in potassium phosphate.

69. $...Cu^{2+}(aq) + ...I^-(aq) \square ....CuI(s) + ...I_2(s)$

When the equation above is balanced and all coefficients are reduced to lowest whole number terms, the coefficient for $I^-(aq)$ is

(A)   1   (B)   2   (C)   3   (D)   4

70. For elements in the left most column of the periodic table, properties that have increasing value as atomic number increases include which of the following ?

I.   Ionization energy(potential)

II.   Atomic radius

III. Atomic mass

(A)   I only   (B)   III only

(C)   I and II only   (D)   II and III only

(E)   I, II and III

71. The number of oxygen atoms in 0.50 mole of $KHSO_4$ is

(A) 1.2×10^{23} (B) 2.4×10^{23} (C) 3.0×10^{23} (D) 1.2×10^{24}

(E) 2.4×10^{24}

72. Analysis by mass of a certain compound shows that it contains by mass 14 % hydrogen and 86% carbon. Which of the following is the most informative statement that can properly be made about the compound on the basis of this data?
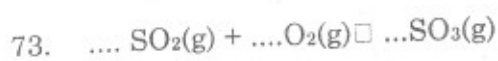
(A)   Is a hydrocarbon   (B)   Its empirical formula is CH_2

(C)   Its molecular formula is C_2H_4 (D)   Its molar mass is 28g/mol

(E)   It contains a triple bond

73. .... $SO_2(g)$ + ...$O_2(g) \square$ ...$SO_3(g)$

According to the reaction represented by the unbalanced equation above, how many moles of $SO_2(g)$ are required to react completely with 1mole of $O_2(g)$?

(A)   0.5 mol   (B)   1 mol   (C)   2 mol   (D)   3 mol

74. Which of the following statements about catalysts is true?

(A)   They increase the value of the equilibrium constant.

(B)   They increase the amount of product present at equilibrium.

(C)   They increase the concentration of the reactants.

(D)   They are permanently altered as the reaction proceeds.

(E)   They reduce the activation energy of the reaction.

75. Raising the temperature at which a chemical reaction proceeds may do all of the following EXCEPT

(A)   increase the molecular collision frequency

(B)   increase the number of molecules with energy greater than the activation energy

(C)   speed up the forward and reverse reactions

(D)   decrease the randomness of the system

(E)   change the relative concentrations of products to reactants that are present at equilibrium.

76. Which of the following most accurately reveals common ancestry among many different species of organisms?

(A)   The amino acid sequence of their cytochrome C

(B)   Their ability to synthesize hemoglobin

(C)   The percentage of their body weight that is fat

(D)   The mechanism of their mode of locomotion

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Questions 77-78

Thymine is used by animal cells primarily for the synthesis of DNA. A group of sea urchin eggs was fertilized in sea water containing radioactive thymine. Following fertilization, samples of embryos were removed at regular intervals and the radioactivity in the nucleic acid was measured in counts per minute. The results obtained are shown in the figure below.
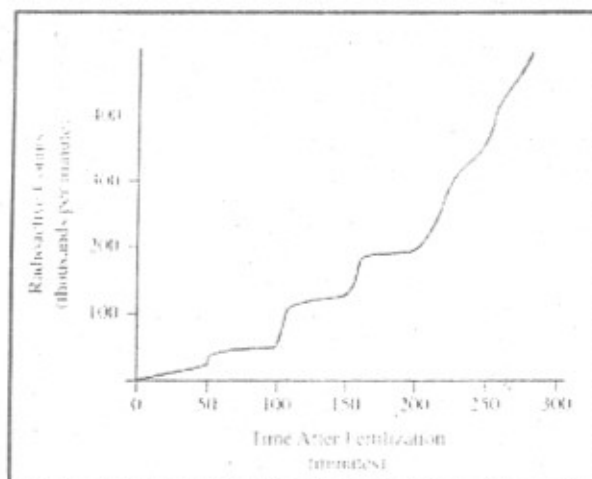
77. The increase in the radioactivity of the embryos with time probably results from

    (A) synthesis of new proteins by the developing embryos

    (B) synthesis of radioactive thymine by the developing embryos

    (C) oxidation of radioactive thymine

    (D) incorporation of radioactive thymine in new cell membranes

    (E) incorporation of radioactive thymine in new DNA during replication

78. An appropriate control to show this experiment measures DNA synthesis and not RNA synthesis would be to perform the same procedures but

    (A) not fertilize the eggs

    (B) sample the embryos at longer time intervals

    (C) add radioactive uracil instead of radioactive thymine

    (D) fertilize the eggs in sea water that does not contain radioactive thymine

    (E) count the number of cells in embryos at the begining and at the end of the experiment

79. True statements about the development of frog and mouse embryos include which of the following?
   I. Both the frog and the mouse embryos develop in an aqueous environment
   II. Both the frog and the mouse embryos depend on a large supply of yolk to sustain the developing embryo
   III. Both the frog and the mouse embryos develop a 4-chambered heart.
   (A) I only   (B) III only   (C) I and II only   (D) I, II and III

80. ATP is produced during which of the following processes?
   I. Photosynthesis   II. Aerobic respiration   III. Fermentation
   (A) I only   (B) II only
   (C) I and III only   (D) II and III only


THE GROWTH OF BACTERIA AT 37° C
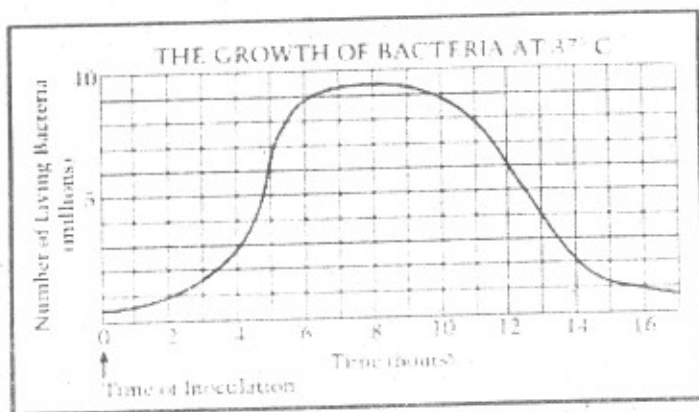
81. In the graph above, the time when the number of living bacteria is increasing at the greatest rate occurs
   (A) during the first 2 hours   (B) between the 2nd and the 4th hour
   (C) between the 4th and the 6th hour (D) between the 11th and the 13th hour

Questions 82-83
   (A) Decomposers (e.g., bacteria)   (B) Producers (e.g., grasses)
   (C) Primary consumers (e.g., mice)   (D) Secondary consumers (e.g., snakes)

82. Organisms that comprise the greatest mass of living substance (biomass) in a terrestrial food chain.

83. Organisms that convert nitrogen-containing organic molecules into nitrates.

84. All of the following are population characteristics EXCEPT
   (A) number of individuals   (B) phenotype
   (C) sex ratio   (D) age distribution

310   18
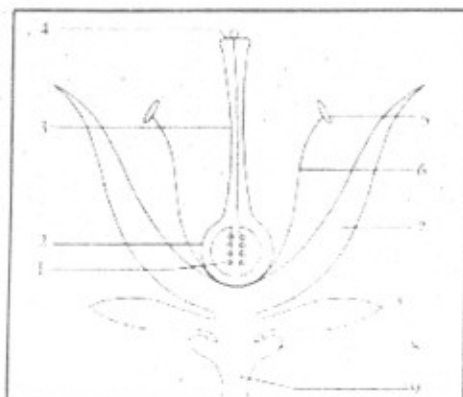
85. Commonly, the fruit is derived from

(A) 2   (B) 4   (C) 7   (D) 8

(E) 9

86. Pollination involves a transfer of pollen from

(A) 4 to 1   (B) 4 to 2   (C) 4 to 5   (D) 5 to 4

(E) 5 to 9

Questions 87-88

In a breeding experiment using gray and white mice of unknown genotypes, the following results were obtained.

|	Parents			Offspring	
Cross	Female		Male	Gray	White
I	Gray	x	White	82	78
II	Gray	x	Gray	118	39
III	White	x	White	0	50
IV	Gray	x	White	74	0

87. If the gray female from cross IV were mated with the gray male from cross II, then which of the following would most likely be true?

(A) All of the offspring would be gray

(B) All of the offspring would be white

(C) Half of the offspring would be gray

(D) One – quarter of the offspring would be gray

(E) One – quarter of the offspring would be white

88. If two gray progeny of cross IV mate with each other, what is the probability that any one individual offspring will be gray?

(A) 100%   (B) 75%   (C) 50%   (D) 25%

(E) 0

Questions 89-90

Three students added equal volumes of pond water to each of four beakers (I – IV) and placed each in a different constant temperature bath, maintained at 5°C, 15°C, 25°C, and 35°C, respectively. The students then added 6 water fleas, *Daphnia pulex*, to each of the four beakers and recorded the time in each case. After 1 hour, the students removed 3 *Daphnia pulex* from each beaker and each student immediately observed one *Daphnia pulex* under low-power magnification of a light microscope. (The transparent body of the *Daphnia pulex* can be seen easily under a light microscope.) Heart rates were recorded as beats per minute. The results of the experiment are summarized in the chart below.

BEAKER	TEMPERATURE	TIME DAPHNIA ADDED	TIME DAPHNIA REMOVED	HEARTBEATS PER MINUTE (average of 3 Daphnia)
I	5°C	2:00 p.m.	3:00 p.m.	41
II	15°C	2:10 p.m.	3:10 p.m.	119
III	25°C	2:20 p.m.	3:20 p.m.	202
IV	35°C	2:30 p.m.	3:30 p.m.	281

89. The independent variable in this experiment is the
    (A) amount of light
    (B) number of water fleas
    (C) pH of the water
    (D) temperature of the water
    (E) average heart rate

90. If a graph is constructed using the data given in the table, it will most closely resemble which of the following?

20
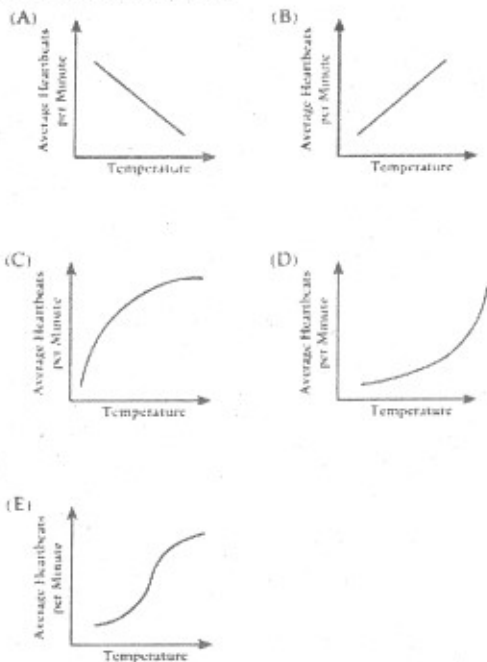
Questions 91-92

Known numbers of seeds from two species (X an Y) of annual plants are mixed together in different proportions and planted in five small plots of soil in the spring. The plants grow, flower, and produce seeds. It is found that the percentage of seeds of species X and Y in the harvest is usually different from the proportion that was planted, although the total number of seeds produced is the same as the number of seeds planted. The data are plotted on the graph below.
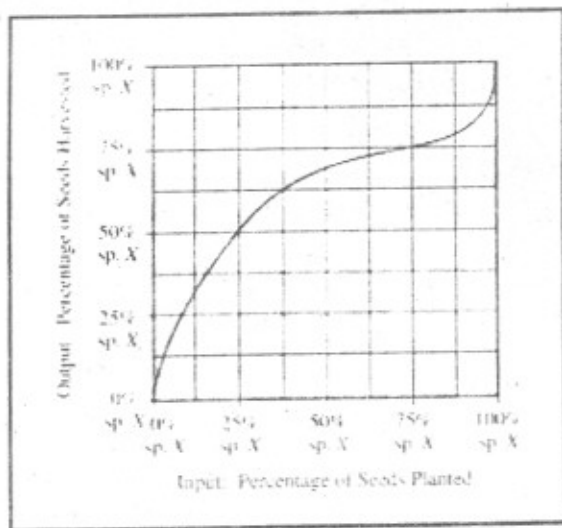
91. What mixture of seeds was harvested in the plot that was planted with 25 percent species X and 75 percent species Y?

	X	Y
(A)	25%	75%
(B)	40%	60%
(C)	50%	50%
(D)	60%	40%
(E)	75%	25%

92. What do the data indicate about the ecological relationship between species X and species Y?

(A)   X and Y are mutualistic for low percentages of X seeds

(B)   X and Y are mutualistic for high percentages of X seeds

(C)   X and Y compete when both X and Y seeds are present

(D)   Y competes successfully against X at all percentages of X and Y seeds

(E)   X is parasite of Y when Y is rare.

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93. Which of the following individuals is most fit in evolutionary terms?
    (A) A child who does not become infected with any of the usual childhood diseases, such as measles or chicken pox
    (B) A women of 40 with seven adult offspring
    (C) A women of 80 who has one adult offspring
    (D) A childless man who can run a mile in less than five minutes

94. A microscopic unicellular organism is observed to have the following characteristics: a food gullet, a flagellum, chloroplasts, mitochondria, and a nucleus. This organism belongs to which kingdom?
    (A) Protista   (B) Plantae   (C) Fungi   (D) Animalia
    (E) Monera

95. A stream is free of pollutants within a few miles downstream of a point at which a small amount of sewage is being dumped into it. This is most likely the result of
    (A) succession   (B) eutrophication
    (C) evaporation   (D) photosynthesis
    (E) decomposition

96. Which of the following correctly explains how a favorable genetic trait can increase in frequency in a population?
    (A) Lamarck's principle   (B) Natural selection
    (C) Adaptive radiation   (D) Genetic recombination
    (E) Segregation of alleles

97. The change in plant types inhabiting an area over time, resulting in a climax community
    (A) Succession   (B) Dispersion   (C) Fertilization   (D) Speciation
    (E) Mutation

98. In animals, ritualized contests with little risk of serious injury or death to participants within the species lead to
    (A) a stable dominance hierarchy   (B) biological altruism
    (C) adaptive radiation   (D) instinctive behaviour
    (E) a broader habitat

99. Nitrogenous base that occurs in RNA but not in DNA
    (A) Deoxyribose   (B) Ribose   (C) Uracil   (D) Cytosine

100. Sugar that occurs in DNA but not in RNA
    (A) Deoxyribose   (B) Ribose   (C) Uracil   (D) Cytosine