RCL No. Marks Obtained (for office use):

Name:

Preference for interview panel (put tick mark): Bio / Others

Instructions:

- **Answering Section A is compulsory. Choice of answering either Section B or Section C.**
- Correct Answer: +2
- Incorrect Answer: -1
- **Time allowed: 1 hour**
- **All question four options of which only one is correct. Clearly circle your choice if any.**

Section A

1. A car travels 50 m. east, followed by 50 m. north, and finally 100 m. west. How far is the car from its starting point?
   (a) 50 m.
   (b) 100 m.
   (c) $50\sqrt{2}$
   (d) $50/\sqrt{2}$

2. What comes next: ABP, ECQ, IDR, OFS, ___?
   (a) PGT
   (b) UGT
   (c) UHX
   (d) PHX

3. There are *p* balls and *q* baskets ($p > q$). Which of the following is always true if the balls are put randomly in the boxes.
   (a) There is no empty basket.
   (b) There are (p-q) baskets with at least one ball.
   (c) There is at least one basket with two or more balls.
   (d) There are (p-q) baskets with exactly two balls.

4. The market price of a car is Rs. 50 Lakhs. You buy the car at a discount of 20% on the market price. To make a 20% profit, you should sell the car at?
   (a) 50 Lakhs
   (b) 32 Lakhs
   (c) 60 Lakhs
   (d) 48 Lakhs

5. You are given an unlimited supply of matchsticks to make a 3 dimensional volume. What is the fewest number of edges that are needed to make this 3-dimensional volume?
   (a) 12
   (b) 4
   (c) 3
   (d) 6

6. I went to buy 1 kg rice, and on coming home I discovered that it contains 5% (by weight) white stones. If I remove half the stones from the rice, what is the percent of stones remaining in the mix?
   (a) 2.5%
   (b) 2.49%
   (c) 2.56%
   (d) 2.1%

7. A coin is tossed a 100 times. What is the probability that we see at least one Heads in these 100 tosses?
   (a) 1/100
   (b) 99/100
   (c) $1 - (1/2)^{100}$
   (d) $(1/2)^{100}$

8. N cubes, each with surface area ‘a’ and volume ‘v’, are placed side by side in a single row to form a cuboid. What is the surface area ‘A’ and volume ‘V’ of the cuboid.
   (a) A = 2N(a/3)+a/3; V = N.v
   (b) A = Na; V = N.v
   (c) A = 4N(a/3)+a6; V = N.v
   (d) A = N.a/6; V = N.v/3

9. An equilateral triangle of side T, a square of side S, and a regular pentagon of side P have equal area. Which of the following is true?
   (a) T > S > P
   (b) T < S < P
   (c) T = S = P
   (d) None of the above.

10. The income distribution of residents of a city for two years looks like the graph below.What can we say about the distribution from this graph?

(a) average income in year 'A' is more than that in year 'B'

(b) average income in year 'A' is less than that in year 'B'

(c) standard deviation of income in year 'A' is more than that in year 'B'

(d) standard deviation of income in year 'B' is more than that in year 'A'

Section B

1. A factory was owned by three people X, Y and Z, each having an equal share. X sold half his share to Y. Z sold one quarter of his share to Y. What fraction did Y then own?
   A. 1/2
   B. 7/12
   C. 5/12
   D. 3/4

2. The area of a rectangle with sides *x* and 3*x*, is how many times greater than the area of a right angled isosceles triangle whose hypotenuse equals *x*?
   A. 1.5
   B. 3
   C. 6
   D. 12

3. A measuring cylinder is filled one third full with ethanol. A mixture of equal proportions of ethanol, water and propanol is used to fill the measuring cylinder to its capacity. What fraction of the final mixture is ethanol?
   A. 5/9
   B. 2/3
   C. 4/9
   D. 7/9

4. Chen donates 15 percent of his current salary to charity. If his pay is increased by 10 percent and he still continues to donate 15 percent of the salary, by what percentage does his charity contribution increases?
   A. Cannot be determined
   B. 15
   C. No change
   D. 10

5. One litre of 50% (w/w) H_2SO_4 solution in water is mixed with 2 litres of 75% (w/w) H_2SO_4 solution in water. What is the percentage concentration (w/w) of H_2SO_4 in the resulting solution? $\rho_{H_2SO_4}$(50%) = 1.39 kg/litre and $\rho_{H_2SO_4}$(75%) = 1.66 kg/litre.
   A. 57.4
   B. 67.6
   C. 55.9
   D. 76.6

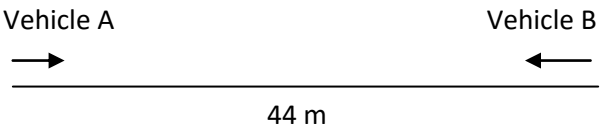
6. $\int \ln(x)\, dx$

   A. e^x-1
   B. $xlnx$
   C. $xlnx - 1$
   D. $x(lnx - 1)$

7. $\sqrt{2\sqrt{2\sqrt{2\sqrt{2\sqrt{\cdots}}}}}\infty =$

   A. Cannot be determined
   B. 2
   C. 4
   D. 8

8. Vehicles A and B start in opposite directions 44m apart. Vehicle A goes at a constant speed of 10 m/s. Vehicle B decelerates at a rate of 0.2m/s^2 from an initial velocity of 10 m/s. After how many seconds do the vehicles A and B meet?

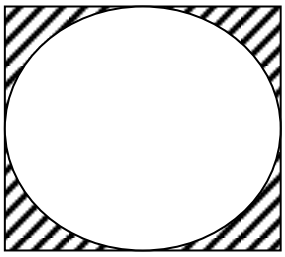


   A. 3.27
   B. 6.73
   C. 2.25
   D. 1.2

9. A swimmer covers a distance of 1 km in 1/6th of an hour while swimming downstream (in the direction of the river flow) and covers the same distance in ½ an hour while swimming upstream (against the river flow). Find the speed of the river flow in km/h.
   A. 4
   B. 3
   C. 1
   D. 2

10. Average age of grandfather, father and son is 55 years. Average age of father and son is 40 years. What is grandfather's age?
   A. 70
   B. 85
   C. 80
   D. 75

11. A circle is inscribed in a square as shown below. If the shaded area is A, find the length S of the side of the square.



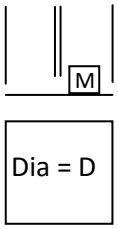
A. $S = \sqrt{\frac{4\pi A}{4-\pi}}$

B. $S = \sqrt{\frac{(4-\pi)A}{4}}$

C. $S = \sqrt{\frac{4A}{4-\pi}}$

D. $S = 2\sqrt{A}$

12. A mass M is kept on an ideal cylinder and piston arrangement (weightless piston and no friction) as shown in the figure. If the diameter of the cylinder is D, find the minimum pressure, P, in the cylinder to move the piston.



A. $P = \frac{4Mg}{\pi D^2}$

B. $P = \frac{Mg}{\pi D^2}$

C. $P = \frac{4M}{\pi D^2}$

D. $P = \frac{M}{\pi D^2}$

13. Four boys and four girls sit in a circle. In how many ways can they be seated so that the boys and girls alternate?

A. 16

B. 256

C. 576

D. 676

14. The door of the electrically powered refrigerator in your kitchen is kept open on a hot summer day. This _____ the temperature in the kitchen
    A. increases
    B. decreases
    C. does not change
    D. none of the above

15. An electric motor runs “hot” under load, owing to internal irreversibilities. It has been suggested that the associated energy loss be minimized by thermally insulating the motor casing. Comment critically on this suggestion.
    A. Insulating the motor helps prevent increase in temperature and hence prevents damages to the motor
    B. Causes the temperature of the motor to rise to such high temperatures that damages may occur
    C. Insulating the motor has no effect
    D. None of the above

Section C

1. Enzymes work by:
A. Lowering the activation energy for a reaction
B. Increasing the activation energy for a reaction
C. Depending on the reaction, increasing/decreasing the activation energy for a reaction.
D. None of the above.

2. Which of the following results from transcription:
A. tRNA
B. mRNA
C. rRNA
D. All the above

3. The term proteomics is best defined by:
A. study of fungal proteins
B. quantum physics of DNA
C. study of collection of proteins expressed an organism
D. none of the above

4. If you mix 1 Lt of 'A' of pH 7 with 1 Lt of 'B' of pH 5 what will be the resultant pH?
A. 6
B. 5.3
C. 6.6
D. 5, it won't change as pH 7 is neutral

5. In resting cells, proteins X and Y are localized in the cytosol. Upon stimulation with lipopolysaccharide (LPS), both of them are phosphorylate and translocate to the nucleus. You have used antibodies against phosphorylated forms of proteins X and Y which are conjugated to red, green or blue dye. Keeping optical aberration of light in mind, which one of the following will be the best for visualizing X and Y in the nucleus by fluorescence microscopy?
A. Anti green X and anti red Y
B. Anti red X and anti green Y
C. Anti red X and anti blue Y
D. Anti blue X and anti green Y

6. Fibroblasts from prematurely aging patients with progeria have
A. DNA mismatch repair
B. Mitochondrial defect
C.Chromosomal translocation
D. Short telomeres

7. Which enzymes remove supercoiling in replicating DNA ahead of the replication fork?
A. Helicases
B. DNA polymerases
C. Topoisomerases
D. Ligases

8. The cell membrane will have more fluidity, if
A. Increased amount of cholesterol and more unstaturation
B. More unsaturation and less fatty acid chain length
C. less fatty acid chain length and increased amount of cholesterol
D. all of the above

9. Which of the following is NOT involved in protein synthesis?
A. Rough ER
B. Smooth ER
C. Golgi Body
D. Ribosomes

10. Allopatric speciation occurs when population shows
A. reproductive isolation
B. ecological isolation
C. seasonal isolation
D. geographical isolation

11. Adherent cells migrate depending on availability of the adhesion sites, usually up a gradient. Such migration is called
A. Chemotaxis
B. Durotaxis
C. Haptotaxis
D. Rheotaxis

12. Which of the following statement is NOT correct
A. Operons contains a cluster of genes under the control of a single promoter
B. Operons are found only in prokaryotes
C. Repressor binds to an operator and blocks transcription
D. Presence of Operons makes the gene regulation efficient

13. All of the following statements apply to G proteins except
A. G proteins transmit a signal from the cell surface to the interior of the cell
B. all G proteins have a similar structure
C. G proteins do not use second messengers but transmit the signal directly into the nucleus
D. G proteins act to amplify the signal creating a cascade response in the cell

14. A peptide bond
A. has a partial double bond character
B. is ionized at physiological pH
C. is stable to heating in strong acids
D. occurs most commonly in cis configuration

15. In an *in vitro* experiment, you want to check your hypothesis that condition "A" results into expression of "X". To check your hypothesis, you plan to use an inhibitor which blocks A and then to use immuno fluorescence to detect '"B". Which of the following controls will you use in your experiment?
A. Culture with condition A but without the inhibitor
B. Culture without condition A without the inhibitor
C. Culture with condition A but without the inhibitor and without the primary antibody
D. All of the above