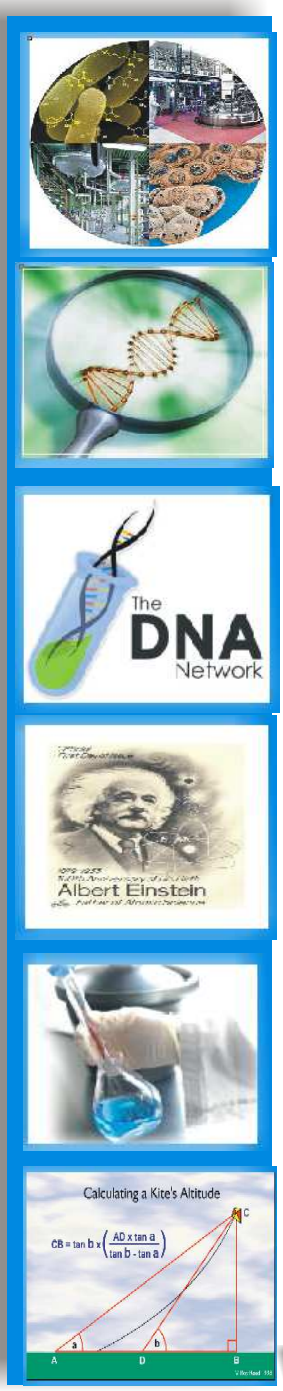

TIFR - BIOLOGY

MOCK TEST PAPER

- **There are Sixty (60) questions divided into four parts (Part A , B, C & D).**
- **Questions (1-10) carry one mark each and Questions (11-15) carry two marks each. 1/2 marks wiil be deducted for each wrong answer.**
- ***Pattern of questions : MCQs***
- ***Total marks : 80***
- ***Duration of test : 2 Hours***

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SECTION A :(GENERAL)

1. Amylose and cellulose are two straight chain polysaccharides of glucose. The difference is

(A) Amylose is water soluble, cellulose is not

(B) Amylose reduces Tollen's reagent, cellulose does not

(C) Amylose reduces Fehling's solution, cellulose does not

(D) Amylose has $\beta\rightarrow(14)$ linkages between its monomers while cellulose has $\alpha\rightarrow$ (14) linkages.

2. During photosynthesis oxygen is generated from

(A) Carbon dioxide only

(B) Water only

(C) Both carbon dioxide and water

(D) Phosphoglycerate

3. Which of the following is not characteristic of genomic libraries?

(A) They include introns as well as exons

(B) They contain random fragments of genomic DNA

(C) They include cDNA copies of mRNA

(D) They contain promoter sequences

4. An enzyme catalyzing the reaction Glycerate-3-phosphate $\longleftrightarrow$ Glycerate-2-PO_4 would have an EC number with first digit

(A) 2

(B) 4

(C) 5

(D) None of the above

5. Stomata close during water deficit in response to

(A) Abscisic acid

(B) Phytochrome

(C) Ethylene

(D) Cytokinin

6. Harmonic mean is defined as the reciprocal of_____.

(A) Arithmetic mean

(B) Geometric meal

(C) Arithmetic mean of the reciprocal of observations

(D) Geometric mean of the reciprocal of the given individual observations.

7. $\frac{1}{D^2-1}\sin x =$

(A) $\sin x$

(B) $\frac{1}{2}\sin x$

(C) $2\sin x$

(D) $-\frac{1}{2}\sin x$

8. The point on the x-axis, which is equidistant from the points A (2,1) and B (1,3) is

(A) $\left(\frac{-5}{2},0\right)$

(B) (4,0)

(C) $\left(\frac{-3}{2},0\right)$

(D) (–1,0)

9. If $z = (2 - 3i)$ and $z^2 - 4z + 13 = 0$, what is the value of $4z^3 - 3z^2 + 169$?

(A) 169

(B) 0

(C) 4z + 169

(D) 3i – 13

10. The total area of the rectangles in a histogram is equal to

(A) Class frequency divided by the total frequency

(B) Cumulative frequency multiplied by number of rectangles

(C) Total area bounded by the corresponding frequency polygon in the Y-axis

(D) Total area bounded by the corresponding frequency polygon in the X-axis.

11. If the earth shrinks to half of its radius without change in mass, the duration of the day will be

(A) 48 hrs

(B) 24 hrs

(C) 12 hrs

(D) 6 hrs

12. A wheel having moment of inertia 2 kg-m^2 about its vertical axis, rotates at the rate of 60 rpm about this axis. The torque which can stop the wheel's rotation in one minute would be:

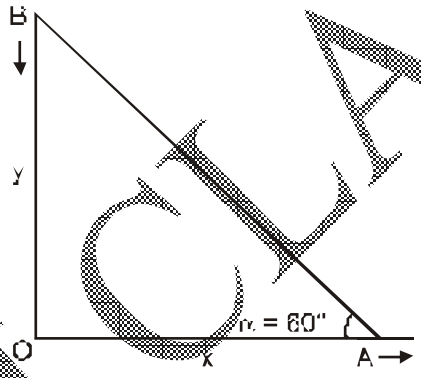
(A) $\frac{2\pi}{15}$ N – m

(B) $\frac{\pi}{12}$ N – m

(C) $\frac{\pi}{15}$ N – m

(D) $\frac{\pi}{18}$ N – m

13. Two particles A and B are connected by a rigid rod AB. The rod slides along perpendicular rails as shown here. The velocity of A to the right is 10 m/s. What is the velocity of B when angle $\alpha = 60°$?



(A) 9.8 m/s

(B) 10 m/s

(C) 5.8 m/s

(D) 17.3 m/s

14. The early stage of river system represented by

(A) Oxbow lake

(B) Alluvial fans

(C) Gorges

(D) Alluvial cones

15. When the eastern edge of the plate passed over the Kerguelen hot spot, a chain of islands began to form near long 90°E. The Indian plate continued to move northward at an accelerated rate of

(A) 15–20 cm/yr.

(B) 5–10 cm/yr.

(C) 25 –30 cm/yr.

(D) 0 – 5 cm/yr.

SECTION B: (PHYSICS)

1. A nucleus with mass number 220 initially at rest emits an α – particle. If the Q - value of the reaction is 5.5 MeV, calculate the kinetic energy of the α – particle?

(A) 4.4 MeV

(B) 3.4 MeV

(C) 5.4 MeV

(D) 5.2 MeV

2. The normal Zeeman splitting of the cadmium red line of 6438Aº when the atoms are placed in a magnetic field of 0.009 tesla is

(A) 1.74×10^{-4} Å

(B) 2.43×10^{-3} Å

(C) 4.62×10^{-4} Å

(D) 2.59×10^{-2} Å

3. Two fixed charges -2Q and Q are located at the points with coordinates (-3a, 0) and (3a,0) in the x-y plane. The locus of all points in the x-y plane where the electric potential due to the charges is zero is a /an

(A) Straight line

(B) Ellipse

(C) Circle

(D) Parabola

4. Two bodies *M* and *N* of equal masses are suspended from two separate massless springs of spring constants K_1 and K_2 respectively. If the two bodies oscillate vertically such that their maximum velocities are equal, the ratio of their amplitude of vibration of *M* to that of *N* is

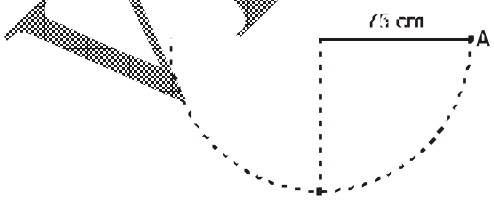
(A) K_1 / K_2

(B) $\sqrt{K_1 / K_2}$

(C) K_2 / K_1

(D) $\sqrt{K_2 / K_1}$

5. If the simple pendulum shown in figure is released from point A, the speed of the bob as it passes through equilibrium point is



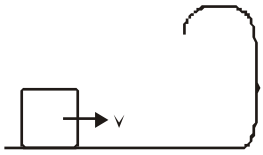
(A) $\sqrt{7\cdot35}\,ms^{-1}$

(B) $\sqrt{14 \cdot 7} ms^{-1}$

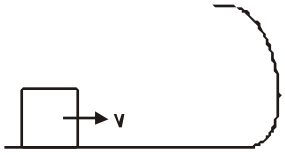
(C) $\sqrt{10 \cdot 03} ms^{-1}$

(D) $\sqrt{21 \cdot 05} ms^{-1}$

6. A small block is shot into each of the four tracks as shown below. Each of the tracks rises to the same height. The speed with which the block enters the track is the same in all cases. At the highest point of the track, the normal reaction is maximum in



(A)



(B)

(C)

(C)

7. The engine of a car produces acceleration 4 m/s^2 in the car. If this car pulls another car of same mass, what will be the acceleration produced?

(A) 8 m/s^2

(B) 2 m/s^2

(C) 4 m/s^2

(D) $\frac{1}{2} m/s^2$

8. A car when passes through a convex bridge exerts a force on it which is equal to

(A) $Mg - \frac{Mv^2}{r}$

(B) 2.5 kg

(C) Mg

(D) 4 kg

9. The temperature of an ideal gas is increased from 120 K to 480 K. If at 120 K the root mean square velocity of the gas molecules is at 480 K it becomes

(A) 4ν

(B) 2ν

(C) ν/2

(D) ν/4

10. The plate resistance of a triode is 3×10^3 Ω and its mutual conductance is 1.5×10^{-3} A/ V. The amplification factor of the triode is

(A) 5×10^{-5}

(B) 4.5

(C) 45

(D) 2×10^5

11. Two thin long parallel wires separated by a distance b are carrying a current i ampere each. The magnitude of the force per unit length exerted by one wire on the other is

(A) $\frac{\mu_0 i^2}{b^2}$

(B) $\frac{\mu_0 i^2}{2\pi b}$

(C) $\frac{\mu_0 i}{2\pi b}$

(D) $\frac{\mu_0 i}{2\pi b^2}$

12. A current I flows along the length of an infinitely long straight, thin-walled pipe. Then

(A) The magnetic field at all points inside the pipe is the same, but not zero

(B) The magnetic field at any point inside the pipe is zero

(C) The magnetic field is zero only on the axis of the pipe

(D) The magnetic field is different at different points inside the pipe

13. A prism has a refracting angle of 60°. When a ray is incident at 50°, it suffers minimum deviation (δ_m). The value of is

(A) 45°

(B) 60°

(C) 55°

(D) 40°

14. When an electron jumps from the fourth orbit to the second orbit, one gets the

(A) Second line of Paschen series

(B) Second line of Balmer series

(C) First line of Pfund series

(D) Second line of Lyman series

15. A sinusoidal voltage V(t) = 200 sin 1000t is applied across a pure inductive coil of inductance L = 0·2H. The current and instant power will be

(A) 20 cos 100t, 200 sin 2000t

(B) 200 cos 1000t, 2000 sin 2000t

(C) cos 1000t, 100 sin 2000t

(D) 10 cos 1000t, 1000 sin 2000t

SECTION C :(CHEMISTRY)

1. Chlorobenzene on hydrolysis with SiO_2 gives

(A) C_6H_5OH

(B) C_6H_5CHO

(C) C_6H_5COOH

(D) C_6H_6

2. Cellulose is indigestible by humans because we lack the enzyme that hydrolyzes

(A) α-1,4 glycosidic bonds (B) α-1,6 glycosidic bonds

(C) β-1,4 glycosidic bonds (D) long-chain polysaccharides

3. For the reaction, $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ equilibrium constant, K_p changes with:

(A) Total pressure

(B) Catalyst

(C) Amount of H_2 and I_2 present

(D) Temperature

4. In which case, a spontaneous reaction is impossible at any temperature?

(A) ΔH + ve, ΔS + ve

(B) ΔH + ve, ΔS – ve

(C) ΔH – ve, ΔS – ve

(D) In all cases

5. Which of the following does not react with nitrous acid?

(A) $C_6H_5NH_2$

(B) $C_6H_5NHCH_3$

(C) $(CH_3)_2NH$

(D) $(C_6H_5)_3N$

6. Suppose that a polymer of glucose with alternating $\alpha(1 \rightarrow 4)$ and $\beta(1 \rightarrow 4)$ glycosidic linkages has just been discovered.

(P) This polymer would have primarily a structural role in organisms

(Q) This polymer would have primarily an energy storage role in organisms

(R) Ruminants could use this polysaccharide as a food source.

Which of the following statement is / are correct?

(A) Q, R

(B) Only R

(C) P, R

(D) Only Q

7. The elements which occupy the peaks of ionization energy curve are

(A) Na, K, Rb, Cs

(B) Na, Mg, Cl, I

(C) Cl, Br, I, F

(D) He, Ne, Ar, Kr

8. Which of the following carboxylic acids will have highest pk_a value?

(A) $CH_3 \cdot CH_2 \cdot CF_2 \cdot COOH$

(B) $CH_3 \cdot CF_2 \cdot CH_2 \cdot COOH$

(C) $CHF_2 \cdot CH_2 \cdot CH_2 \cdot COOH$

(D) $CH_3 \cdot CH_2 \cdot CHF \cdot COOH$

9. A complex $[CoL_6]^{n+}$, where L is a neutral ligand has a magnetic moment m = 4·5 BM. Hence

(A) Co must be in + 2 oxidation state

(B) L must be a strong ligand

(C) The complex must be highly distorted

(D) Co must be + 3 oxidation state

10. Toluene gives following reaction:

$$\text{Toluene} \xrightarrow[\text{ii) } CH_3O^-]{\text{i) NBS}/\Delta} A$$

Which one of the following statements is correct?

(A) A is benzyl alcohol, ionic mechanism and S_N1 reaction

(B) A is methyl benzoate, electrophilic aromatic and S_N2 reaction elimination reaction

(C) A is benzyl methyl ether, free radical mechanism and S_N2 reaction

(D) None of the above

11. In the borax bead test of CO^{2+} the blue colour of bead is due to the formation of

(A) B_2O_3

(B) CO_3B_2

(C) $Co(BO_2)_2$

(D) CoO

12. Which of the following statement is wrong?

(A) Increasing the level of ATP favors both gluconeogenesis and glycogen synthesis

(B) Decreasing the level of Fructose -1,6 -bisphosphate would stimulate glycogen synthesis

(C) Level of fluctions -6- phosphate do not have a marked regulatory effect on gluconeogenesis and glycogen synthesis.

(D) All are true

13. In the system, $CaF_2(s) \rightleftharpoons Ca^{2+} + 2F^-$, increasing the concentration of Ca^{2+} ions 4 times will cause the equilibrium concentration of F^- ions to change to –

(A) 1/4 of the initial value

(B) 1/2 of the initial value

(C) 2 times of the initial value

(D) None of the above

14. $C_6H_6(\iota)+\frac{15}{2}O_2(g)\rightarrow 3H_2O(\iota)+6CO_2(g);\ \ \Delta H=-3264.4\ kJ\ mol^{-1}$

According to the above reaction, the energy obtained by burning 3.9 g of benzene in air will be

(A) 163.23 kJ

(B) 326.4 kJ

(C) 32.64 kJ

(D) 3.264 kJ

15. 2.5 L of a sample of gas at 27°C and 1 bar pressure is compressed to a volume of 500 mL keeping the temperature constant, the percentage increase in pressure is:

(A) 100%

(B) 400%

(C) 500%

(D) 80%

SECTION D: (BIOLOGY)

1. How does nucleotide-excision repair differ from base-excision repair?

(A) Base-excision repair recognizes and removes single damaged bases, whereas nucleotide-excision repair is more general, recognizing many different kinds of lesions that distort the DNA molecule

(B) Nucleotide-excision repair reverses the chemical reaction that caused the lesion, whereas base excision repair removes the damaged bases and replaces them with normal ones

(C) Only the base is removed in base-excision repair, whereas the entire nucleotide is removed in nucleotide-excision repair

(D) Base-excision repair requires no protein components, and can occur by simple absorption of UV light, whereas nucleotide-excision repair requires several enzymes

2. A strain of E.coli has a temperature-sensitive mutation which inactivates the 3' → 5' exonuclease activity of DNA polymerase III (Pol- III). When grown at the non-permissive temperature for this mutation, these cells are likely to show

(A) Failure to initiate DNA replication

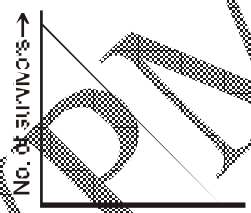
(B) Arrest during replication

(C) Elevated mutation rate

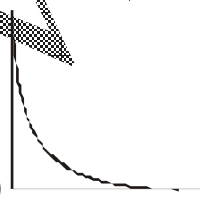
(D) Unregulated replication

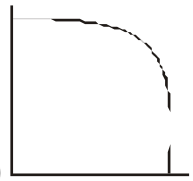
3. Survivorship curve of the species in which the population mortality rate is low until near the end of the life span?

(A)



(B)



(C) 

(D) None

4. C-value paradox suggest us about

(A) Co- linearity between genome size and complexity of organism

(B) Non-co linearity between genome size and complexity of organism

(C) Dosage compensation

(D) Number of chromosome

5. Consider the following statements regarding linkage of genes:

1. Two genes are said to be linked when they fail to show independent assortment.

2. The strength of the linkage is determined by the distance between the two genes.

3. The strength of the linkage is directly proportional to the distance between the two genes.

Of these statements:

(A) 1, 2 and 3 are correct

(B) 1 and 2 are correct

(C) 2 and 3 are correct

(D) 1 and 3 are correct

6. Two pink-flowered four-o'clocks are crossed to each other. Flower colour is incompletely dominant and giving phenotypic ratio if 1 red: 2 pink: 1 white. What are the following probabilities?

P. The first three plants with white flower

Q. A plant with either white or pink flower

(A) P. 1/64 Q. 3/4

(B) P. 3/16 Q. 1/64

(C) P. 3/64 Q. 9/16

(D) P. 1/64 Q. 3/4

7. What is meant by the steady-state assumption that underlies the Michaelis-Menten relationship between substrate concentration and reaction velocity?

(A) The reaction velocity is linearly related to substrate concentration

(B) The reaction velocity is independent to substrate concentration

(C) The rate of breakdown of the enzyme-substrate complex equals the rate of formation of the complex

(D) The rate of formation of product equals the rate of disappearance of substrate

8. Suppose you are given a strain of Drosophila exhibiting an unknown abnormal genetic trait (mutation). We mate the mutant females to males from a balanced that strain ($Cy\ P_m^+ / Cy^+\ P_m, DSb^+ / D^+\ Sb$) where curly wings (Cy) and plum eye (P_m) are on chromosome 2 and dichaete wing (4) and stubble bristles (Sb) are on chromosome 3. Homozygosity for either curly, plum, dichaete or stubble is lethal. The trait does not appear in the F1. The F1 males with early wings and stubby bristles are then backcrossed to the original mutant females. In the progeny the mutation appear in equal association with curly and stabble. The mutation is

(A) Dominant

(B) Recessive

(C) Can't say anything (data insufficient)

(D) None

9. When dominant epistasis is operative between two gene loci, the classical 9 : 3 : 3 : 1 ratio becomes modified into:

(A) 9 : 3 : 4 ratio

(B) 9 : 6 : 4 ratio

(C) 12 : 3 : 1 ratio

(D) 15 : 1 ratio

10. Which of the statement is false about the fluctuation of intraocular pressure? The introcular pressure fluctuate.

(A) Seasonally being higher in the winter

(B) Diurnally with the circadian rhythm being higher in the morning

(C) With fluid intake, the intraocular pressure increases with increased bold fluid

(D) Do not fluctuate with eye movements

11. The cut surface of an apple turns brown when in contact with air. IF the cut apple is dipped is ascorbic acid, browning does not takes place. This is because ascorbic acid

(A) Prevents release of polyphenol from damaged cells

(B) Prevents drying of cut surface

(C) Inhibits activity of polyphenol oxidase (PPO)

(D) Overcomes cells injury caused by cutting

12. Dibromothymoquinone, an inhibitor of cytochrome bf complex of photosynthetic electron transport chain was added to the green alga Chlamydomonas. After illumination it was found that in the alga

(A) Plastoquinone was in reduced state

(B) p700 was in reduced state

(C) Plastocyanin was in reduced state

(D) Plastoquinone was in oxidized state

13. Histone acetylation increases transcription of gene because

(A) It increase the DNA-histone interaction

(B) The acetyl groups on histones are recognized by the RNA polymerase

(C) Histone acetylation loosens the DNA-histone complex, thereby making it more accessible to RNA polymerase

(D)Histone acetylation induces DNA bending which is recognized by RNA polymerase

14. Choose the wrong statement

Yersinia pestis, the organism which causes plague, is able to survive in its host

(A) By inhibiting phagocytosis by macrophages through a protein Era-1

(B) By inhibiting activation of complement cascade through a protein Yad A

(C) By inhibiting signal transduction in phagocytic cells through a protein YopH

(D) By release of cytotoxin which destroys actin molecules through a protein plasma.

15. All your cells contain proto-oncogenes, which can change into cancer-causing genes. Why do cells possess such potential time bombs?

(A) Protooncogenes protect cells from infection by cancer-causing viruses

(B) Protooncogenes are genetic junk that has not yet been eliminated by natural selection

(C) Protooncogenes are unavoidable environmental carcinogens

(D) Protooncogenes are necessary for normal control of cell division

ANSWER KEY

SECTION A :(GENERAL)

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	A	B	C	A	A	C	D	A	B	A	D	C	D	C	B

SECTION B: (PHYSICS)

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	C	A	C	D	B	A	B	A	B	B	B	B	D	B	C

SECTION C: (CHEMISTRY)

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	A	C	D	B	D	C	D	C	D	C	C	B	B	A	B

SECTION D: (BIOLOGY)

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	A	C	B	B	B	A	C	B	C	D	C	A	C	C	A

HINTS AND SOLUTION

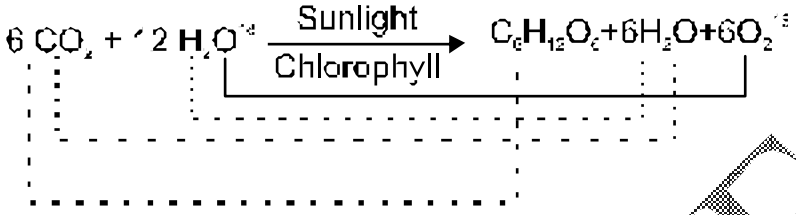
SECTION A :(GENERAL)

1.(A) Amylose is water soluble whereas cellulose is insoluble in water.

As both are the polysaccharides of glucose so produces the reducing sugar test & in amylose $\alpha\rightarrow$ (14) linkage is presents whereas in cellulose $\beta\rightarrow$ (14) linkage is present.

2.(B) Ruben and Kamen proved that oxygen released by green plants comes from splitting of water (oxidation of water) by experimenting on Chlorella (a green alga).

He used water (H_2O) having heavy isotope of oxygen (O^{18}) and found that oxygen released in the process of photosynthesis was of O^{18} type.



3.(C) A genomic library is a collection of plasmid clones or phage lysates containing recombinant DNA molecules so that the sum total of DNA inserts in this collection, ideally represents the entire genome of concerned organism. Similarly when these clones are cDNA they are collectively called a cDNA library.

4.(A) The given enzymatic reaction :

Glycerate-3-phosphate $\longleftrightarrow$ Glycerate-2-PO_4

can be catalyzed by an **phospho glucomutases** which belong to **Transferases** group of enzyme having **EC number '2'**

5.(A) Abscisic acid (AbA) is a water stress plant hormone, so stomata closes during water deficit in response to AbA

6.(C) Harmonic mean is the arithmetic mean of the reciprocal of observations.

7.(D) $\frac{1}{D^2-1}\sin x = \frac{1}{-(1)^2-1}\sin x \Rightarrow \frac{1}{-1-1}\sin x \Rightarrow -\frac{1}{2}\sin x$

8.(A) Let the point be $P(x_1 y_1)$

Since it lies on x axis $\Rightarrow y_1 = 0$

So PA = PB

$$\sqrt{(2-x_1)^2+1^2} = \sqrt{(1-x_1)^2+3^2}$$

On squaring

$$4 + x^2 - 4x + 1 = 1 + x^2 - 2x + 9$$

$$\Rightarrow \quad 2x + 5 = 0$$

$$\Rightarrow \quad x = -\frac{5}{2}$$

Then P becomes $\left(-\frac{5}{2}, 0\right)$

9.(B) $Z = Z - 3i$ is one of the root of $Z^2 - 4Z + 13$

if $Z = 2 - 3i$

$4Z^3 - 2Z^2 + 169 = 4(-46 - 9i) + 3(5 + 12i) + 169 = 0$

10.(A) Area of the rectangles in a histogram is proportional to class frequency

So Area = $\frac{\text{class frequency}}{\text{Total frequency}}$

11.(D) Using conservation of angular momentum $(\text{As } \vec{\tau}_{ext} = 0) \Rightarrow \vec{\tau}_{ext} = 0$

$$\Rightarrow \frac{d\vec{L}}{dt} = 0 \Rightarrow \vec{L} = \text{constant}$$

$$I\omega = I\left(\frac{2\pi}{T}\right) = \text{constant} \Rightarrow I \propto T$$

As $I = \frac{2}{5}MR^2 \Rightarrow R^2 \propto T$

So $\frac{R^2}{(R/2)^2} = \frac{24\text{hr}}{T} \Rightarrow T = 6\text{hr}$

12.(C) Given : $I = 2\ \text{kg - m}^2$, $\omega_0 = \frac{60}{60} \times 2\pi\ \text{rad/s}$,

$\omega = 0$, $t = 60$ s

The torque required to stop the wheel's rotation is

$$\tau = I\alpha = I\left(\frac{\omega_0 - \omega}{t}\right)$$

$$\therefore \quad \tau = \frac{2\times 2\pi\times 60}{60\times 60} = \frac{\pi}{15}\text{N-m}$$

13.(D) Let the velocity along x and y axes by v_x and v_y respectively.

$$\therefore \quad v_x = \frac{dx}{dt} \text{ and } v_y = \frac{dy}{dy}$$

From figure.

$$\tan\alpha = \frac{y}{x}$$

$$\Rightarrow \quad y = x\tan\alpha$$

Differentiating Eq. (i) w.r.t. t, we get

$$\frac{dy}{dt} = \frac{dx}{dt}\tan\alpha$$

$$\Rightarrow \quad Vy = v_x \tan\alpha$$

Here, $v_x = 10$ m/s, $\alpha = 60°$

$$\therefore \quad v_y = 10\tan 60° = 10\sqrt{3} = 17.3 \text{ m/s}$$

14.(C) The early stage of river system represented by Gorges.

15.(B) When the eastern edge of the plate passed over the Kerguelen hot spot, a chain of islands began to form near long 90°E. The Indian plate continued to move northward at an accelerated rate of 5–10 cm/yr.

SECTION B : (PHYSICS)

1.(C) $N^{220} \longrightarrow {}_2He^4 + N^{116}$

Q value of the reaction = 5.5 MeV

$\therefore \quad (KE)_{He} + (KE)_N = 5.5 \text{ MeV} \quad \ldots(1)$

$$(KE)_{He} = \frac{P^2}{2m_{He}}, (KE)_N = \frac{P^2}{2m_N}$$

then $$\frac{(KE)_{He}}{(KE)_N} = \frac{m_N}{m_{He}}$$

$$(KE)_N = \frac{m_{He}}{m_N} (KE)_{He}$$

Here $m_{He} = 4$

$m_N = 220$

$$\therefore \quad (KE)_N = \frac{4}{220} (KE)_{He} \quad \ldots(2)$$

From (1) and (2)

$$(KE)_{He} + \frac{4}{220} (KE)_{He} = 5.5 \text{ MeV}$$

$$(KE)_{He} \left[1 + \frac{4}{220}\right] = 5.5 \text{ MeV}$$

$$(KE)_{He} \left[\frac{224}{220}\right] = 5.5 \text{ MeV}$$

$$(KE)_{He} = \frac{5.5 \times 220}{224} \text{MeV} = 5.4 \text{ MeV}$$

2.(A) $\therefore \quad B = \dfrac{4\pi mc}{e}\dfrac{\Delta\lambda}{\lambda^2}$

$$\Delta\lambda = \frac{Be\lambda^2}{4\pi mc} = \frac{0\cdot09\times1\cdot6\times10^{-19}\times6438\times10^{-10}\times6438\times10^{-10}}{4\times3\cdot14\times9\cdot1\times10^{-31}\times3\times10^{8}}$$

$$= 1740\cdot65 \times 10^{-16} m = 1.74 \times 10^{-13} m$$

$$\Delta\lambda = 1\cdot74\times10^{-3} A^0$$

3.(C) $\boxed{v = \dfrac{Q}{4\pi\varepsilon_0 r}}$

Therefore, equipotential potentials are such that distance from – 2Q charge is twice distance from + Q charge

$$\sqrt{(x-(-3a))^2+(y-0)^2} = 2\sqrt{(x-3a)^2+(y-0)^2}$$

$\Rightarrow (x + 3a)^2 + y^2 = 4(x - 3a)^2 + 4y^2$

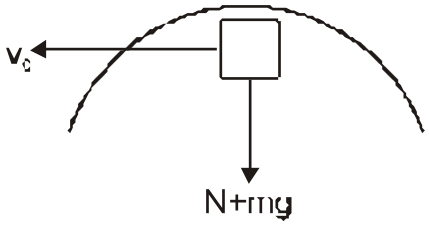
$\Rightarrow 3x^2 + 3y^2 - 30ax + 27a^2 = 0$ Hence the locus is a circle

4.(D) $X = A\sin\sqrt{\dfrac{k}{m}}t \Rightarrow \dfrac{dx}{dt} = A\sqrt{\dfrac{k}{m}}\cos\sqrt{\dfrac{k}{m}}t$

$$U_{max} = \frac{dx_1}{dt}(max) = \frac{dx_2}{dt}(max) \Leftrightarrow A_1\sqrt{\frac{k_1}{m}} = A_2\sqrt{\frac{k_2}{m}} \Rightarrow \frac{A_1}{A_2} = \sqrt{\frac{K_2}{K_1}}$$

5.(B) $\dfrac{1}{2}mv^2 = mgl \quad \Rightarrow v = \sqrt{g\times0.75\times2} = \sqrt{1.5g} = \sqrt{14.7}$

6.(A) Since, the block rises to the same heights in all the four cases, from conservation of energy, speed of the block at highest point will be same in all four cases. Say it is v_0.



Equation of motion will be $N + mg = \frac{mv_0^2}{R}$

or $N = \frac{mv_0^2}{R} - mg$

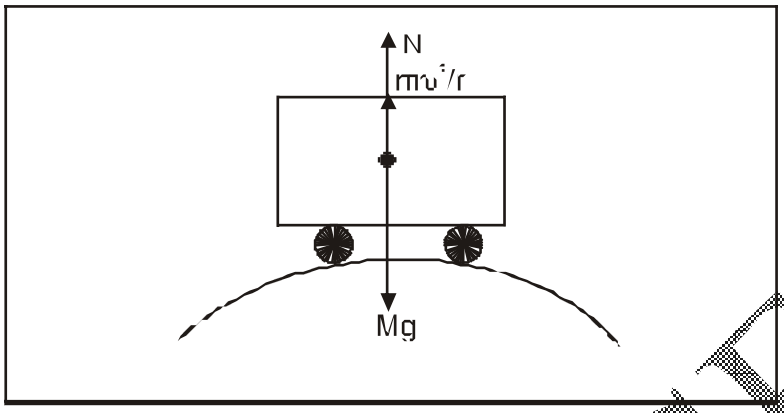
R (the radius of curvature) in first case is minimum. Therefore, normal reaction N will be maximum in first case.

Note In the question it should be mentioned that all the four tracks are frictionless. Otherwise, v_0 will be different in different tracks.

7.(B) $a = \frac{F}{m}$ according to newton's law,

$$a' = \frac{F}{2m} = a/2 = 4/2 = 2ms^{-2}$$

8.(A) From fig., $N = \left(Mg - \frac{Mv^2}{r}\right)$



9.(B) $$v_{rms} = \sqrt{\frac{3RT}{M}}$$

i.e. $$v_{rms} \propto \sqrt{T}$$

When temperature is increased from 120 K to 480 K (i.e, four times), the root mean square speed will become $\sqrt{4}$ or 2 times ie, 2v

10.(B) Given $r_p = 3 \times 10^3\ \Omega$

$g_m = 1.5 \times 10^{-3}$ A/V

$\therefore$ Amplification factor, $\mu = g_m \times r_p = 4.5$

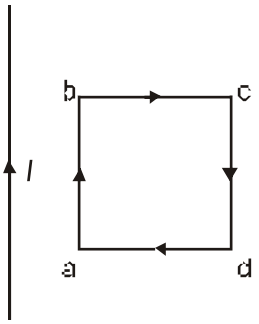
$\therefore$ correct option is (b)

11.(B) Force per unit length between two wires carrying currents i_1 and i_2 at distance r is given by :

$$\frac{F}{l} = \frac{\mu_0}{2\pi}\frac{i_1 i_2}{r}$$

Here, $i_1 = i_2 = i$

and $r = b$



$$\therefore \quad \frac{F}{l} = \frac{\mu_0 i^2}{2\pi b}$$

$\therefore$ correct option is (B)

12.(B) Using Ampere's circuital law over a circular loop of any radius less than the radius of the pipe, we can see that net current inside the loop is zero. Hence , magnetic field at every point inside the loop will be zero.

13.(D) in minimum deviation position ,

$$i_1 = i_2 = 50^\circ ; A = 60^\circ$$

From $A + \delta_m = i_1 + i_2$

$$\delta_m = i_1 + i_2 - A = 50 + 50 - 60 = 40^\circ$$

14.(B) Jump to the second orbit leads to Balmer series. The jump from 4th orbit shall give rise to second line of Balmer series

15.(C) $\because$ $V(t) = 200 \sin 1000\, t$

$L = 0.2$ H

The current will be

$$I = I_0 \sin\left(\omega t - \frac{\pi}{2}\right)$$

$$= \frac{V_0}{\omega L} \sin\left(\omega t - \pi/2\right)$$

$$= \frac{200}{1000 \times 0.2} \cos 1000\ t$$

$$= \cos 1000\ t$$

The instant power will be

$$P = VI$$

$$= 200 \sin 1000\ t \times \cos 1000\ t$$

$$= 200 \times 2\ \frac{(\sin 1000\ t \cos 1000\ t)}{2}$$

$$= 100 \sin 2000\ t$$

SECTION C :(CHEMISTRY)

1.(A) $C_6H_5—C\ell \xrightarrow[\text{KOH}]{\text{Hydrolysis}} C_6H_5OH$

2.(C) Cellulose is a polysaccharide with β – 1, 4 – glucose linkages which can't be digested by enzymes in Humans.

3.(D) K_p changes only with temperature, mode of representing the change and stoichiometry of change.

4.(B) For a spontaneous process ΔG = – ve.

Also, $\Delta G = \Delta H - T\Delta S$

Thus, given conditions in (b), reveals ΔG = + ve,

5.(D) Tertiary Amines (3º) do not react with $NaNO_2$/HCl.

6. (C) This polymer would be expected to have a structural role. The presence of the β-glycosidic linkage makes it useful as food only to termites or to ruminants; these animals harbor bacteria capable of attacking the β-linkage in their digestive tracts.

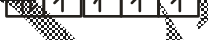
7.(D) The inert gases have the highest ionization energy so He, Ne, Ar, Kr occupy the peaks of ionization energy curve.

8.(C) $pK_a = -\log K_a \propto \frac{1}{K_a} \propto \frac{1}{\text{Acidic nature}} \propto \frac{1}{-I \text{ effect}}$

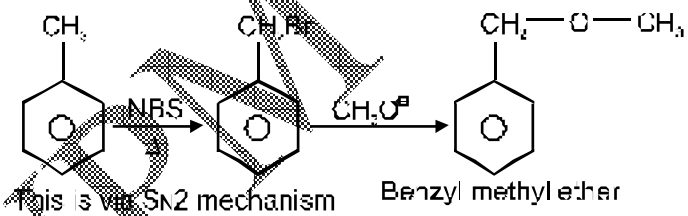
(For highest pK_a, –I effect should be minimum w.r.t –COOH group).

9.(D) Since $BM = 4.5 \Rightarrow \sqrt{n(n+2)} = 4.5 \Rightarrow$ n = 4 = unpaired electron

So, Co must be in +3 oxidation state and ligand L should be a weak ligand

$Co^{3+} = [Ar]_{18}\ 3d^6 4s^0 = [Ar]_{18}$  $4s^0$

10.(C)



This is via S_N2 mechanism

Benzyl methyl ether

11.(C) In the borax bead test of CO^{2+} the blue colour of bead is due to the formation of $Co(BO_2)_2$.

12. (B) Decreasing the level of fructose -1, 6-biphosphate would tend to stimulate glycolysis; rather than gluconeogensis or glycogen synthesis.

13.(B) KC = $[Ca^{2+}]$ $[F-]2$; if [Ca2+] = 4 × [Ca2+] ;

To have KC constant [F–] should be $\frac{[F^-]}{2}$

14.(A) According to reaction

1 male C_6H_6 give $\longrightarrow$3264.4 kJ energy

1 mole = [12 × 6 + 1 × 6] = 78 g C_6H_6 give $\longrightarrow$ 3264.4 kJ energy

$\therefore$ 3.9 g C_6H_6 give $\longrightarrow 3.9\times\frac{3264.4}{78}\text{kJ} = 163.23\text{ kJ}$

15.(B) Apply Boyle's law equation

$$P_1V_1 = P_2V_2$$

or $$P_2 = \frac{P_1V_1}{V_2} = \frac{1(\text{bar})\times 2.5(\text{L})}{500\times 10^{-3}(\text{L})} = 5\text{ bar}$$

$$\%\text{ increase} = \frac{\text{increase}\times 100}{\text{initial pressure}} = \frac{5-1}{1}\times 100 = 400\%$$

SECTION D: (BIOLOGY)

1.(A) Base excision repair recognizes and removes single damaged bases, whereas nucleotide - excision repair is more general, recognizing many different kinds of lesions that distort DNA molecule.

2.(C) The ε -subunit contains the catalytic site for the 3' $\rightarrow$ 5' proofreading exonuclease that functions in the DNA pol III core to edit nucleotides misinserted by the α-subunit DNA pol.

3.(B) A highly convex curve is characteristic of the species in which the population mortality rate is low until near the end of the life span. Many species of large animals such as deer, mountain sheep and man show such curves.

4.(B) In lower eukaryotes like yeast, amount of DNA increase with increasing complexity of organisms. However, in higher eukaryotes there is no correlation between genome size and genetic complexity. This lack of correlation between genome size and genetic complexity is refers to C-value paradox.

5.(B) Linked genes are genes located close together and continue to remain together during inheritance thus, do not follow independent assortment and strength of linkage depends on the distance between 2 linked genes. Lesser the distance, more the strength of linkage.

6.(A) • The probabilities that the first three plants white flower is 1/64.

Use product rule – $1/4 \times 1/4 \times 1/4 = 1/64$.

• The probabilities that a plant with either white or pink flower is 3/4.

Use sum rule,

• The probabilities that a plant with either white or pink flower is 3/4.

Use sum rule, $\frac{1}{4} + \frac{1}{2} = \frac{3}{4}$.

7.(C) The steady-state assumption that underlies the Michaelis-menten relationship is the rate of formation of ES complex is equal to that of the breakdown of ES complex.

8.(B) If the mutation were a dominant (let us designate it M) then each member of the strain would be of genotype MM. Since the trait does not appear in our lethal balanced lethal stock, they must be homozygous recessive. Crosses between these two lines would be expected to produce only heterozygous genotype and

would be phenotypically of the mutant type. But since the mutant type did not appear in the F1, the mutation must be recessive.

9.(C) The dominant allele can express itself only in presence of either B or b i.e. Dominant epistasis. The ratio of such epistasis is 12 : 3 : 1.

10.(D) The introcular pressure fluctuate with eye movement being higher when the eye is moved away from the primary position.

11.(C) The surface of an apple turns brown when in contact with air. If the cut apple is dipped in ascorbic acid, browning does not takes place because ascorbic acid inhibits activity of polyphenol oxidase.

12.(A) As we know, dibromothymoquinone which is an inhibitor of cytochrome of complex of photosynthetic electron transport chain. It was added to the green alga chlamydomonas. After illumination it was found that in the algae plastoquinone was in reduced state because dibromothymoquinone inhibit block electron flow through cyt bf complex.

13.(C) Histone acetylation and deacetylation control chromatin activity. Enzyme that acetylate histones are called histone acetyl transferases (HATs). Acetylation appears to function at several levels to influence gene expression. Due to loss of positive charges when the charged Lys side chains are modified, the affinity between histones and DNA have reduced. The net effect is that RNA polymerase and transcription factors find it easier to access the promoter region.

14.(C) When yersinia bacterium contact with macrophage yop injected into the cytoplasm of the target cell, where it catalyzes a rapid and specific dephosphorylation of several macrophage proteins that are required for normal phagocytosis.

15.(A) Cell possess protooncogenes because they protect cells from infection by cancer-causing viruses.