FIITJEE - JEE (Main)

SAMPLE TEST - 1

Time Allotted: 3 Hours **Maximum Marks: 360**

- Do not open this Test Booklet until you are asked to do so.
- Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.

Important Instructions:

1. Immediately fill in the particulars on this page of the Test Booklet with *Blue / Black Ball Point Pen. Use of pencil is strictly prohibited.*
2. The Answer Sheet is kept inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars carefully.
3. The test is of **3 hours** duration.
4. The Test Booklet consists of **90** questions. The maximum marks are **360**.
5. There are ***three*** sections in the question paper I, II, III consisting of **Physics, Chemistry** and **Mathematics** having 30 questions in each section of equal weightage. Each question is allotted **4 (four)** marks for correct response.
6. *Candidates will be awarded marks as stated above in instruction No.5 for correct response of each question. ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.*
7. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instruction 6 above.
8. Use ***Blue / Black Ball Point Pen only*** for writing particulars / marking responses on ***Side-1*** and ***Side-2*** of the Answer Sheet. ***Use of pencil is strictly prohibited.***
9. No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc. except the Admit Card inside the examination hall / room.
10. On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator on duty in the Room / Hall. ***However, the candidates are allowed to take away this Test Booklet with them.***
11. **Do not fold or make any stray marks on the Answer Sheet.**

Name of the Candidate (in Capital Letters) :_____

Enrolment Number :_____

Batch :_____ **Date of Examination :** _____

Useful Data Chemistry:

Gas Constant	R	=	$8.314\ J\ K^{-1}\ mol^{-1}$
		=	$0.0821\ Lit\ atm\ K^{-1}\ mol^{-1}$
		=	$1.987 \approx 2\ Cal\ K^{-1}\ mol^{-1}$
Avogadro's Number	N_a	=	6.023×10^{23}
Planck's Constant	h	=	6.626×10^{-34} Js
		=	6.25×10^{-27} erg.s
1 Faraday		=	96500 Coulomb
1 calorie		=	4.2 Joule
1 amu		=	1.66×10^{-27} kg
1 eV		=	1.6×10^{-19} J

Atomic No : H=1, D=1, Li=3, Na=11, K=19, Rb=37, Cs=55, F=9, Ca=20, He=2, O=8, Au=79.

Atomic Masses: He=4, Mg=24, C=12, O=16, N=14, P=31, Br=80, Cu=63.5, Fe=56, Mn=55, Si = 28 Pb=207, u=197, Ag=108, F=19, H=2, Cl=35.5

Useful Data Physics:

Acceleration due to gravity $g = 10\ m/s^2$

Section – I (Physics)

1. A particle is projected vertically upwards with a velocity of 20 m/sec. Find the time at which the distance travelled is twice the displacement

(A) $2 + \sqrt{4/3}$ sec. (B) 1 sec. (C) $2 + \sqrt{3/4}$ (D) 3 sec

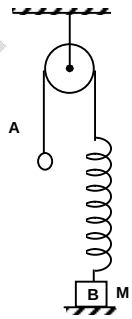
2. Two men who can swim with a speed v_1 in still water start from the middle of a river of width d and move in opposite directions always swimming at an angle θ with the banks. What is the distance between them along the river when they reach the opposite banks, if the velocity of the river is v_2

(A) $\frac{dv_1}{dv_2}\cot\theta$ (B) $\frac{dv_1\cos\theta}{v_1+v_2}$ (C) $\frac{dv_2}{v_1}\tan\theta$ (D) $\frac{v_2 d}{v_1\sin\theta}$

3. A uniform chain of mass m hangs from a light pulley, with unequal lengths of the chain hanging from the two sides of pulley the force exerted by moving chain on the pulley is

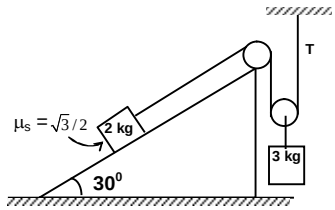
(A) = mg
(B) > mg
(C) < mg
(D) either b or c depending upon acceleration of chain

4. In the figure ball A is released from rest, when the spring is at its natural length. For the block B of mass M to leave contact with the ground at some stage, the minimum mass of A must be



(A) 2M
(B) M
(C) M/2
(D) a function of M and force constant of spring.

5. A system is shown in figure pulleys and strings are ideal system is released from rest



$a_1 \rightarrow$ acceleration of 2 kg, a_2 = acceleration of 3 kg
(i) $a_1 = 2a_2$ (ii) $a_2 = 2a_1$ (iii) $a_1 = a_2 = 0$
(iv) Tension T in the string = 15 N
(v) frictional force between 2 kg & incline = 5N
(vi) frictional force between 2 kg & incline = 15N
(A) (ii), (iv) & (vi) are correct (B) (iii), (v) are correct
(C) (iii), (iv) & (v) are correct (D) (i), (iv) & (vi) are correct

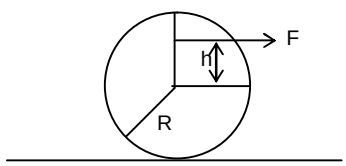
6. A bullet of mass 10 gm is fired from a rifle with a velocity of 800 m/s. After passing through a mud wall 180 cm thick, the velocity drops to 100 m/s. The average resistance of the wall is

(A) 750 N (B) 1250 N (C) 1750 N (D) 2250 N

7. A body is gently dropped on a conveyor belt moving 3 m/s. If μ = 0.5 how far will the body move relative to the belt before coming to rest? ($g = 10 m/s^2$)

(A) 0.3 m (B) 0.6 m (C) 0.9 m (D) 0.8 m

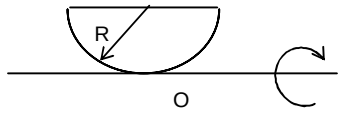
8. Consider the disc kept on a rough horizontal surface as shown in the diagram. If a horizontal force 'F' has to be applied such that the disc starts pure rolling, what should be the value of 'h' ?



(A) R
(B) R/3
(C) R / 2

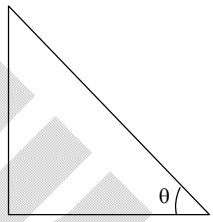
(D) Body can't start pure rolling for any value of 'h'

9. Moment of inertia of a half shell of mass 'M' about an axis tangential to it, as shown, would be



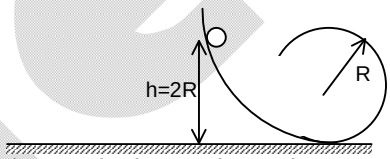
(A) $\frac{2}{3}MR^2$ (B) $\frac{1}{3}MR^2$ (C) MR^2 (D) none of these

10. Consider '3' bodies namely a disc 'A', a sphere 'B' and a hollow cylinder all with same mass and radius being released from top of fixed inclined plane. If t_A, t_B & t_c be the time they take to reach the bottom, find the correct alternative for each of given situations.



In absence of any friction
(A) $t_C > t_A > t_B$ (B) $t_C < t_A < t_B$ (C) $t_C = t_A = t_B$ (D) none of these

11. A small ball starts rolling on an inclined track which becomes loop if radius R in vertical plane.



(A) speed of the ball at highest point is zero but and highest point is 2R above the ground.
(B) speed of the ball at highest point is non zero but highest point is 2R above the ground
(C) speed of the ball is along horizontal at highest point and highest point is less than the 2R above the ground.
(D) speed of the ball is along horizontal at highest point but height of highest point above the ground can not be calculated.

12. A double star consists of two stars having mass M and 2M. The distance between their centre is equal to r. They revolve under their mutual gravitational interaction. Then which of the following statements is/are correct.
(A) heavier star revolves in orbit of radius r/3
(B) kinetic energy of heavier star is twice of that of the other star.
(C) lighter star revolves in orbit of radius $\frac{2r}{5}$
(D) all above are correct.

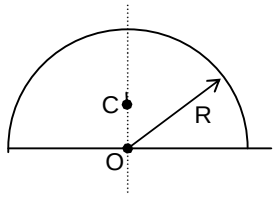
13. Three small identical bodies each of mass m are moving in circular orbit around a fixed point with same angular velocity under their gravitational interaction. If the separation between any two bodies is R, the total energy possessed by the system is given by

(A) $-\frac{3GM^2}{2R}$ (B) $-\frac{3GM^2}{4R}$ (C) $-\frac{3GM^2}{2R\cos 30^\circ}$ (D) $-\frac{3GM^2}{R}$

14. A man of mass M stands at one end of a plank of length L which lies at rest on a frictionless surface. The man walks to the other end of the plank. If the mass of the plank is M/3, the distance that the man moves relative to the ground is

(A) $\frac{3L}{4}$ (B) $\frac{4L}{5}$ (C) $\frac{L}{4}$ (D) $\frac{L}{3}$

15. The centre of mass of a half disc shown is at C while O is the centre. Thus OC is



(A) R/2 (B) $2R/\pi$

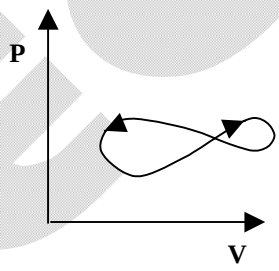
(C) $\frac{4R}{3\pi}$ (D) none of the above

16. If the tension in a stretched string fixed at both ends in changed by 20%, the fundamental frequency is found to change by 15 Hz. Then the
(A) original frequency is 150 Hz
(B) velocity of propagation of the transverse wave along the string changes by 5 %
(C) velocity of propagation of the transverse wave along the string change by 10 %
(D) fundamental wavelength on the string does not change.

17. Beats are produced by two progressive waves. Maximum loudness at the waxing is x times the loudness of each wave. The value of x is

(A) 1 (B) $\sqrt{2}$ (C) 2 (D) 4

18. A thermodynamic system undergoes a cyclic process as shown in the figure. The cycle consists of two closed loops. Over one complete cycle, the system performs
(A) positive work
(B)negative work
(C) zero work
(D) nothing can be predicted



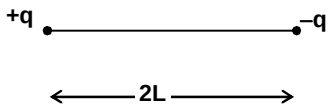
19. A half ring of radius R is charged with a linear charged density λ. The field at the centre is

(A) 0 (B) $k\lambda/R$ (C) $2k\lambda/R$ (D) $k\pi\lambda/R$

20. The maximum electric field strength E due to a uniformly charged ring of radius r, happens at a distance x, where value of x is (x is measured from the centre of the ring)

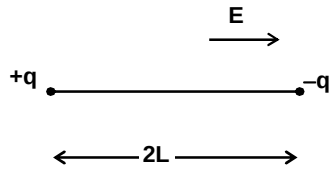
(A) x = R (B) x = R/2 (C) $x = \frac{R}{\sqrt{2}}$ (D) $x = \sqrt{2}\,R$

21. Two charges +q and –q are placed fixed on the corner of a massless rigid rod of length 2L.Calculate the potential energy of the dipole thus formed.



(A) $\frac{1}{4\pi\varepsilon_o}\frac{q^2}{4L^2}$ (B) $\frac{1}{4\pi\varepsilon_o}\frac{q^2}{2L}$ (C) $\frac{1}{2\pi\varepsilon_o}\frac{q^2}{2L}$ (D) None of these.

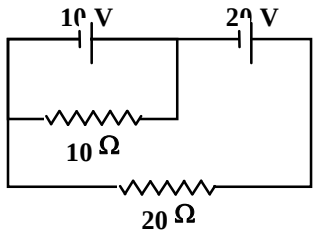
22. If the above discussed dipole is placed in a uniform electric field E as shown, calculate the proper potential energy of the dipole.



(A) $\frac{1}{4\pi\varepsilon_o}\frac{q^2}{2L}$ (B) $4qLE + \frac{1}{4\pi\varepsilon_o}\frac{q^2}{2L}$

(C) $2qLE - \frac{1}{4\pi\varepsilon_o}\frac{q^2}{2L}$ (D) $4qLE - \frac{1}{4\pi\varepsilon_o}\frac{q^2}{2L}$

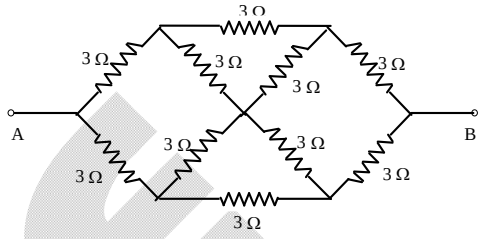
23. In the shown network current through $20\,\Omega$ resistor equals



(A) $\frac{3}{2}$A (B) $\frac{9}{2}$A

(C) 1A (D) $\frac{2}{3}$A

24. Equivalent resistance between the points A and B is



(A) $1\,\Omega$ (B) $2\,\Omega$

(C) $3\,\Omega$ (D) $4\,\Omega$

25. The two rails of a railway track; insulated from each other and the ground, are connected to millivoltmeter. What is the reading of the millivoltmeter when a train passes at a speed of 180 km/hr along the track, given that the horizontal component of earth's magnetic field is 0.2×10^{-4} wb/m^2 and rails are separated by 1 metre

(A) 10^{-2} V (B) 10 mV (C) 1 V (D) 1 mV

26. In an R-L-C circuit v = 20 sin (314 t + 5π/6) and i = 10 sin (314 t + 2π/3)
The power factor of the circuit is

(A) 0.5 (B) 0.966 (C) 0.866 (D) 1

27. A circular current carrying coil has a radius a. The distance from the centre of coil, on its axis, where the magnetic induction will be 1/8 th of its value at centre of coil is

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

28. In photoelectric effect, the photo current

(A) increases with increase of frequency of incident photon
(B) decreases with increase of frequency of incident photon
(C) does not depend on the frequency of the photon but depends only on intensity of incident light.
(D) depends both on intensity and frequency of photon.

29. If refractive index of water is 4/3 and glass is 5/3 then critical angle so that light travelling form glass to water is completely reflected is

(A) $\sin^{-1}$ (4/5) (B) $\sin^{-1}$ (5/4) (C) $\sin^{-1}$ (3/5) (D) $\sin^{-1}$ (5/3)

30. When a ray of light enters a glass slab from air

(A) its wavelength decreases (B) its wavelength increases
(C) its frequency increases (D) neither wavelength nor frequency changes

space for rough work

Section – II (Chemistry)

1. For the equations
$C(diamond)+2H_2(g)\rightarrow CH_4(g);\Delta H_1$
$C(graphite)+2H_2(g)\rightarrow CH_4(g);\Delta H_2$
Predict whether
(A) $\Delta H_1=\Delta H_2$ (B) $\Delta H_1>\Delta H_2$
(C) $\Delta H_1<\Delta H_2$ (D) $\Delta H_1=\Delta H_2+\Delta H_{vap}(3)+\Delta H_{diss}(H_2)$

2. Which of the following can behave as both electrophile and nucleophile?
(A) $CH_3-C\equiv N$ (B) CH_3OH (C) $CH_2=CH-CH_3$ (D) CH_3NH_2

3. Steam reacts with iron at high temperature as follows:
$3Fe(s)+4H_2O(g)\Rightarrow Fe_3O_4(s)+4H_2(g)$
The correct expression for the equilibrium constant (K_P) is:
(A) $\frac{p_{H_2}^2}{p_{H_2O}^2}$ (B) $\frac{(p_{H_2})^4}{(p_{H_2O})^4}$ (C) $\frac{(p_{H_2})^4[Fe_3O_4]}{(p_{H_2O})^4[Fe]^3}$ (D) $\frac{[Fe_3O_4]}{[Fe]}$

4. In which of the following solvents, AgBr has the maximum solubility?
(A) 10^{-3} M NaBr (B) 10^{-3} M NH_4OH (C) Pure water (D) 10^{-3} M HBr

5. The electrode potential of a copper wire dipped in 0.1 M $CuSO_4$ solution at 25^0C (the standard reduction potential of copper is 0.34V):
(A) 0.34V (B) 0.31V (C) 0.349 V (D) 0.28 V

6. The strongest reducing agent among the following is
(A) F^- (B) Cl^- (C) Br^- (D) I^-

7. Diazonium salt decomposes as:
$C_6H_5N_2^+Cl^-\rightarrow C_6H_5Cl+N_2$
At 0^0C, the evolution of N_2 becomes two times faster when the initial concentration of the salt is doubled., Therefore, it is
(A) a first order reaction
(B) a second order reaction
(C) independent of the initial concentration of the salt
(D) a zero order reaction.

8. If 2.68×10^{-3} mole of a solution containing an ion A^{n+} requires 1.61×10^{-3} mole of MnO_4^- for the oxidation of A^{n+} to AO_3^- in an acidic medium, then what is the value of n?
(A) 3 (B) 2 (C) 5 (D) 4

9. The equivalent weight of $MnSO_4$ is half its molecular weight when it is converted to
(A) Mn_2O_3 (B) MnO_2 (C) MnO_4^- (D) MnO_4^{-2}

10. The largest number of molecules is in
(A) 36 g of H_2O (B) 28 g of CO
(C) 46 g of CH_3CH_2OH (D) 54 g of N_2O_5
(Use atomic weight: O = 16, C = 12, N = 14, H = 1)

11. Consider a titration of $K_2Cr_2O_7$ with acidified Mohr's salt solution $\left(FeSO_4.(NH_4)_2SO_4.6H_2O\right)$ using diphenylamine as indicator. The number of moles of Mohr's salt required per mole of dichromate is

$$Fe^{+2} + Cr_2O_7^{2-} \xrightarrow{H^+} Fe^{+3} + Cr^{+3}$$

(A) 3 (B) 4 (C) 5 (D) 6

12. The normality of 0.3 M phosphorus acid $\left(H_3PO_3\right)$ is

(A) 0.1 (B) 0.9 (C) 0.3 (D) 0.6

13. The energy of hydrogen atom in the ground state is -13.6 eV. Its energy corresponding to the quantum number n = 5 is

(A) $-0.54eV$ (B) $-5.40\ eV$ (C) $-0.85eV$ (D) $-2.72eV$]

14. If r_1 is the radius of first orbit of hydrogen atom, then the radii of second, third and fourth orbit in terms of r_1 are

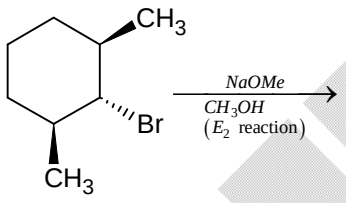
(A) $8r_1, 27r_1, 64r_1$ (B) $2r_1, 6r_1, 8r_1$ (C) $4r_1, 9r_1, 16r_1$ (D) $r_1, 2r_1, 3r_1$

15. If kinetic energy of an electron is increased nine times, the de-Broglie wavelength associated with it would become

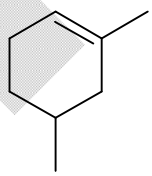
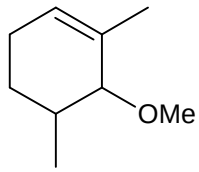
(A) 3 times (B) 9 times (C) $\frac{1}{3}$ times (D) $\frac{1}{9}$ times

16. Which electronic level allows the hydrogen atom to absorb a photon but not emit a photon?

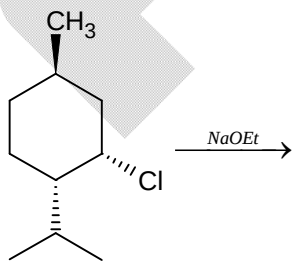
(A) 2s (B) 2p (C) 1s (D) 3d

17. 

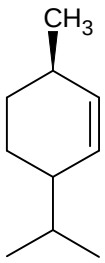
Product. Product of the reaction is:

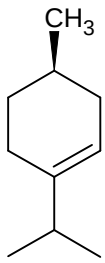
(A)  (B)  (C) 

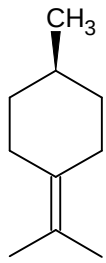
(D) No reaction

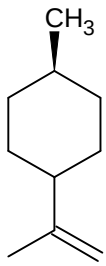
18. 

Major product of the reaction is:

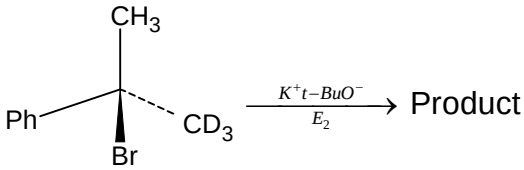
(A) 

(B) 

(C) 

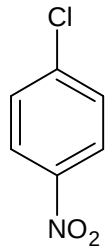
(D) 

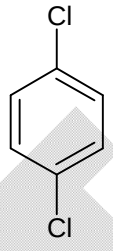
19. Which of the given options best describes the product of the following reaction?

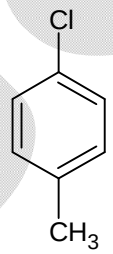


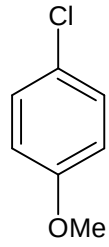
(A) Absolute configuration has been inverted
(B) Absolute configuration has been retained
(C) Racemisation (loss of absolute configuration)
(D) Loss of chirality has occurred (the product is achiral)

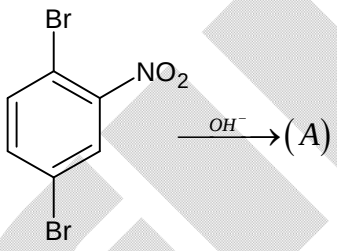
20. Which one of the following undergoes nucleophlic aromatic substitution at the fastest rate?

(A) 

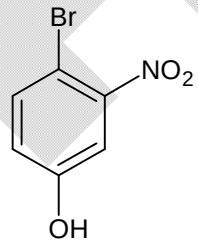
(B) 

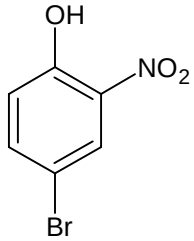
(C) 

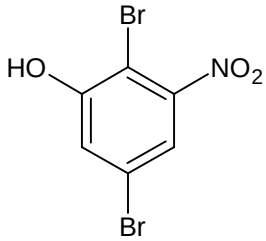
(D) 

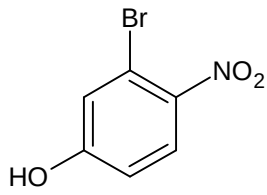
21. 

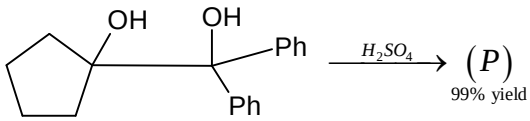
Product of the following reaction is:

(A) 

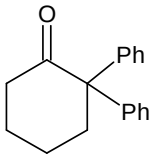
(B) 

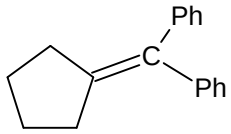
(C) 

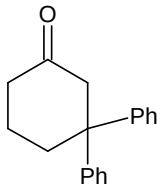
(D) 

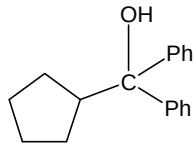
22. 

The product (P) is:

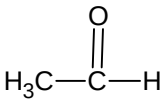
(A) 

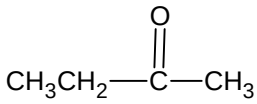
(B) 

(C) 

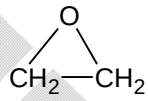
(D) 

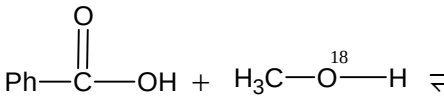
23. An organic compound 'B' is formed by the reaction of ethyl magnesium iodide $\left(CH_3CH_2MgI\right)$ with a substance 'A', followed by treatment with dil. aqueous acid. Compound 'B' doesnot react with PCC. Identify A?

(A) 

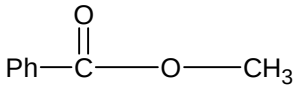
(B) 

(C) $CH_2 = O$

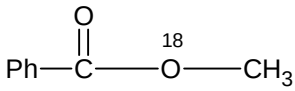
(D) 

24. 

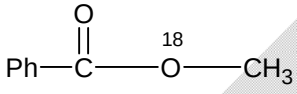
Identify $\left(X\right)$

(A) $X =$ 

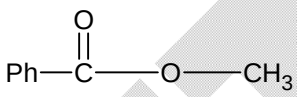
(Esterification)

(B) $X =$ 

(Esterification)

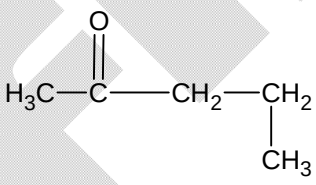
(C) $X =$ 

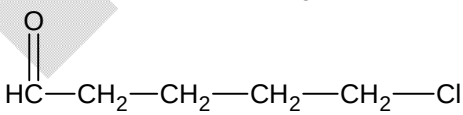
(Saponification)

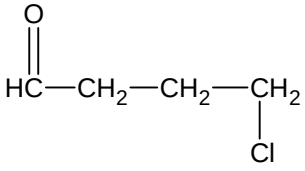
(D) $X =$ 

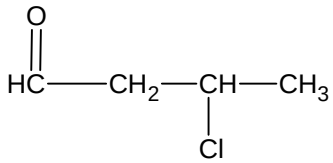
(Hydrolysis)

25. $CH_2 = CH - CH_2 - CH_2 - CH_2OH \xrightarrow[\text{pyridine}]{SOCl_2} (A) \xrightarrow[(H_2O)]{O_3/Zn} (B)$
$\left(C_4H_7ClO\right)$
Compound (B) is

(A) 

(B) 

(C) 

(D) 

26. Equimolar solutions of two non – electrolytes in the same solvent have
(A) same b.pt but different f.pt (B) same f.pt but different b.pt
(C) same b.pt and same f.pt (D) different b.pt and different f.pt

27. The degree of dissociation (α) of weak electrolyte A_xB_y is related to van't Hoff's factor (i) by the expression:
(A) $\alpha = \frac{i-1}{(x+y-1)}$ (B) $\alpha = \frac{i-1}{(x+y+1)}$ (C) $\alpha = \frac{(x+y-1)}{i-1}$ (D) $\alpha = \frac{(x+y+1)}{i-1}$

28. When 20 gm of naphthoic acid $(C_{11}H_8O_2)$ is dissolved in 50 gm of benzene $(k_f = 1.72)$, a freezing point depression of 2k is observed. The van't Hoff factor (i) is
(A) 0.5 (B) 1 (C) 2 (D) 3

29. A 0.004 M solution of Na_2SO_4 is isotonic with a 0.01 M solution of glucose at same temperature. The apparent degree of dissociation of Na_2SO_4 is
(A) 25% (B) 50% (C) 75% (D) 85%

30. If equal volumes of $BaCl_2$ and NaF solutions are mixed, which of these combination will not give a precipitate. $(K_{sp}$ of $BaF_2 = 1.7\times10^{-7})$
(A) $10^{-3}M$ $BaCl_2$ and $2\times10^{-2}M$ NaF (B) $10^{-3}M$ $BaCl_2$ and $1.5\times10^{-2}M$ NaF
(C) $1.5\times10^{-2}M$ $BaCl_2$ and $10^{-2}M$ NaF (D) $2\times10^{-2}M$ $BaCl_2$ and $2\times10^{-2}M$ NaF

pace for rough work

Section – III (Mathematics)

1. $\sum_{r=1}^{n}\left(\frac{{}^{n}C_{r}}{r+1}-\frac{{}^{n+1}C_{r}}{n+1}\right)$ equals to

(A) $\frac{1}{n+1}$ (B) $\frac{-n}{n+1}$

(C) $\frac{-(n+2)}{n+1}$ (D) $\frac{-1}{n+1}$

2. Statement -1: If a, b, c are distinct and x, y, z are not all zero, then

$ax+by+cz=0$

$bx+cy+az=0$

$cx+ay+bz=0$

Gives a + b + c $\neq 0$

Statement – 2: $a^2+b^2+c^2>ab+bc+ca$ if a, b, c are distinct.

(A) **Statement-1** is true, **Statement-2** is true, but Statement**-2** is a correct explanation for **Statement-1.**

(B) **Statement-1** is true, **Statement-2** is true, but Statement**-2** is not a correct explanation for **Statement-1.**

(C) **Statement-1** is true, **Statement-2** is false.

(D) **Statement-1** is false, **Statement-2** is true.

3. If $f(x)$ is an odd periodic function with period 2, then $f(4)$ equals

(A) 0 (B) 2 (C) 4 (D) - 4

4. The solution of the differential equation $2x\frac{dy}{dx}-y=3$ represents

(A) straight lines (B) circle (C) parabola (D) ellipse

5. If [x] denotes the greatest integer less than or equal to x, then the value of $\int_{1}^{5}\left[\left|x-3\right|\right]dx$ is

(A) 1 (B) 2 (C) 4 (D) 8

6. A tower AB leans towards west making an angle α with the vertical. The angular elevation of B, the top most point of the tower, is β, as observed from a point C due east of A at a distance d from A. If the angular elevation of B from a point due east of C is at a distance 2d from C is γ, then

(A) $2\tan\alpha=2\cot\beta-\cot\gamma$ (B) $2\tan\alpha=3\cot\beta-\cot\gamma$

(C) $\tan\alpha=\cot\beta-\cot\gamma$ (D) None of these

7. Let $f(x)=x^3+ax^2+bx+5\sin^2 x$ be an increasing function in the set of real number R. Then

(A) $a^2-3b-15>0$ (B) $a^2-3b+15>0$ (C) $a^2-3b-15<0$ (D) $a>0$ and $b>0$

8. If $a_1, a_2, a_3,...$ are in H.P. and $f(k)=\sum_{r=1}^{n}a_r-a_k$, then $\frac{a_1}{f(1)},\frac{a_2}{f(2)},\frac{a_3}{f(3)},...,\frac{a_n}{f(n)}$ are in

(A) A.P. (B) G.P. (C) H.P. (D) None of these

9. A problem in mathematics is given to 3 students whose chances of solving individually are $\frac{1}{2},\frac{1}{3}$ and $\frac{1}{4}$. The probability that the problem will be solved atleast by one is

(A) $\frac{1}{4}$ (B) $\frac{1}{24}$ (C) $\frac{23}{34}$ (D) $\frac{3}{4}$

10. If $a \in I$ and the equation $(x-a)(x-10)+1=0$ has integral roots, then the values of a are
(A) 6, 8 (B) 8, 10 (C) 10, 12 (D) 8, 12

11. If $2x+\sqrt{6}y=2$ touches the hyperbola $x^2-2y^2=4$, then the point of contact is
(A) $\left(-2,\sqrt{6}\right)$ (B) $\left(-5,2\sqrt{6}\right)$ (C) $\left(\frac{1}{2},\frac{1}{\sqrt{6}}\right)$ (D) $\left(4,-\sqrt{6}\right)$

12. Consider a circle with its centre lying on the focus of the parabola $y^2=2px$ such that it touches the directrix of the parabola. Then a point of intersection of the circle and the parabola is
(A) $\left(\frac{p}{2},p\right)$ or $\left(\frac{p}{2},-p\right)$ (B) $\left(\frac{p}{2},-\frac{p}{2}\right)$
(C) $\left(-\frac{p}{2},p\right)$ (D) $\left(-\frac{p}{2},-\frac{p}{2}\right)$

13. If $\left(a,a^2\right)$ falls inside the angle made by the linear equations $y=\frac{x}{2}, x>0$ and $y=3x, x>0$, then a belongs to
(A) $\left(-3,-\frac{1}{2}\right)$ (B) $\left(0,\frac{1}{2}\right)$ (C) $(3,\infty)$ (D) $\left(\frac{1}{2},3\right)$

14. The straight lines whose direction cosines satisfy $al+bm+cn=0,\ fmn+gnl+hlm=0$ are perpendicular if
(A) $\sqrt{af}+\sqrt{bg}+\sqrt{ch}=0$ (B) $\frac{a^2}{f}+\frac{b^2}{g}+\frac{c^2}{h}=0$
(C) $\frac{f}{a}+\frac{g}{b}+\frac{h}{c}=0$ (D) $a^2f+b^2g+c^2h=0$

15. Domain of derivative of the function f (x) = $|\sin^{-1}(2x^2-1)|$ is
(A) [–1, 1] (B) [–1, 1] ~ $\left\{0,\ \pm\frac{1}{\sqrt{2}}\right\}$
(C) [–1, 1] ~ {0} (D) [–1, 1] ~ $\left\{\pm\frac{1}{\sqrt{2}}\right\}$

16. $\sum_{r=1}^{\infty}\tan^{-1}\left(\frac{1}{r^2+5r+7}\right)$ equals to
(A) $\tan^{-1}3$ (B) $\frac{\pi}{4}$
(C) $\sin^{-1}\frac{1}{\sqrt{10}}$ (D) $\cot^{-1}2$

17. If P_1, P_2, P_3 be the lengths of perpendiculars from the vertices of the triangle ABC to the opposite sides, then
(A) $P_1P_2P_3 = abc$ (B) $P_1P_2P_3 = 8R^3$
(C) $P_1P_2P_3 = \frac{a^2b^2c^2}{R^3}$ (D) $P_1P_2P_3 = \frac{a^2b^2c^2}{8R^3}$
(where R is circumradius of triangle ABC).

18. A unit vector is orthogonal to $5\hat{i}+2\hat{j}+6\hat{k}$ and is coplanar to $2\hat{i}+\hat{j}+\hat{k}$ and $\hat{i}-\hat{j}+\hat{k}$, then the vector is

(A) $\frac{3\hat{j}-\hat{k}}{\sqrt{10}}$ (B) $\frac{2\hat{i}+5\hat{j}}{\sqrt{29}}$

(C) $\frac{6\hat{i}-5\hat{k}}{\sqrt{61}}$ (D) $\frac{2\hat{i}+2\hat{j}-\hat{k}}{3}$

19. If the curve $y = x^2 + bx + c$ touches the straight line $y = x$ at the point (1, 1), then b and c are given by

(A) –1, 1 (B) –1, 2

(C) 2, 1 (D) 1, 1

20. In the sequence 1, 2, 2, 3, 3, 3, 4, 4, 4, 4 ..... , where n consecutive terms have the value n, the 150^{th} term is

(A) 17 (B) 16 (C) 18 (D) none of these

21. The value of $\left\{\frac{5^{2n}}{24}\right\}$, $n \in N$ where {.} denotes the fractional part of x, is

(A) 5/24 (B) 9/24 (C) 1/24 (D) None of these

22. If z_1 and z_2 are two complex numbers satisfying the equation $\left|\frac{z_1+z_2}{z_1-z_2}\right|=1$, then $\frac{z_1}{z_2}$ is a number which is

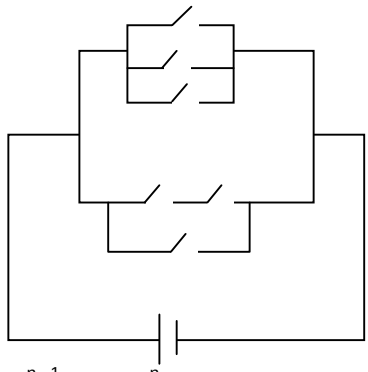
(A) Positive real (B) Negative real

(C) Zero or purely imaginary (D) None of these

23. The number of ways of switching the network such that the bulb glows is

(A) 61 (B) 60

(C) 63 (D) None of these



24. If $2 \sin\theta.\sec 3\theta = \tan 3\theta - \tan\theta$, then $2[\sin\theta.\sec 3\theta + \sin 3\theta.\sec 3^2\theta + ..+\sin 3^{n-1}\theta.\sec 3^n\theta] =$

(A) $\tan 3^n\theta - \tan\theta$ (B) $\tan 3^n\theta - n\tan\theta$ (C) $\tan 3^n\theta - \tan 3^{n-1}\theta$ (D) $\frac{1}{2}(\tan 3^n\theta - \tan\theta)$

25. The determinate $\begin{vmatrix} \cos C & \tan A & 0 \\ \sin B & 0 & -\tan A \\ 0 & \sin B & \cos C \end{vmatrix}$ has the value where A, B, C are angles of a triangle

(A) 0 (B) 1 (C) sinA. sinB (D) cosA cosB cosC

26. The equation of the image of the circle $x^2+y^2+16x-24y+183=0$ by the line mirror $4x+7y+13=0$ is

(A) $x^2+y^2+32x+4y+235=0$ (B) $x^2+y^2-32x+4y+235=0$

(C) $x^2+y^2+32x+4y-235=0$ (D) None of these

27. For hyperbola $\frac{x^2}{\cos^2\alpha}-\frac{y^2}{\sin^2\alpha}=1,$ which of the following remains constant with change in 'α'?

(A) abscissae of vertices
(B) abscissae of foci
(C) eccentricity
(D) directrix

28. If $f(x)=\begin{cases}\frac{\sin[x]}{[x]}, & [x]\neq 0\\ 0, & [x]=0\end{cases}$

Where, [x] denotes the greatest integer less than or equal to x, then $\lim_{x\to 0} f(x)$ equals:

(A) 1 (B) 0 (C) -1 (D) None of these

29. For a real number y, let [y] denote the greatest integer less than or equal to y. Then the function $f(x)=\frac{\tan\pi[(x-\pi)]}{1+[x]^2}$ is:

(A) discontinuous at some x
(B) continuous at all x, but the derivative $f'(x)$ does not exist for some x
(C) $f'(x)$ exists for all x, but the derivative $f''(x)$ does not exist for some x
(D) $f''(x)$ exists for all x

30. $\int\frac{1+(\sin x)^{2/3}}{1+(\sin x)^{4/3}}d(\sin x)^{1/3}$ is equal to

(A) $\frac{1}{\sqrt{2}}\frac{(\sin x)^{2/3}-1}{\sqrt{2}(\sin x)^{1/3}}+c$
(B) $\frac{1}{\sqrt{2}}\tan^{-1}\left(\frac{(\sin x)^{2/3}-1}{\sqrt{2}(\sin x)^{1/3}}\right)+c$
(C) $\frac{1}{\sqrt{2}}\tan^{-1}\left(\frac{(\sin x)^{1/3}-1}{\sqrt{2}(\sin x)^{2/3}}\right)+c$
(D) none of these

space for rough work