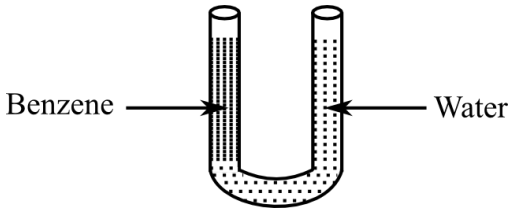
Physics

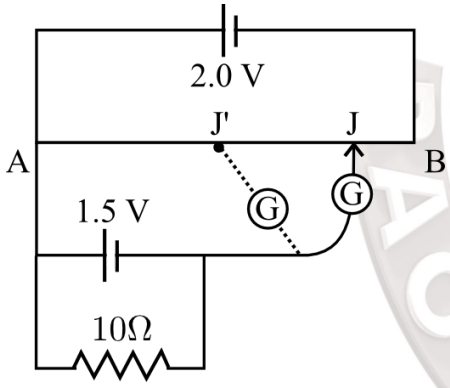
Single Correct Questions +3 | -1

1. A uniform glass tube is bent into a U - tube such as shown in the figure. Water is poured into the tube until it stands 10 cm high in each limb. Benzene (specific gravity = 0.879) is then added slowly in the left limb until the waeer rises 4 cm higher in the right limb. What length is the column of benzene when the situation is reached? Water and benzene do not mix.



(A) 9.1 cm (B) 10.1 cm (C) 20.1 cm (D) 21.1 cm

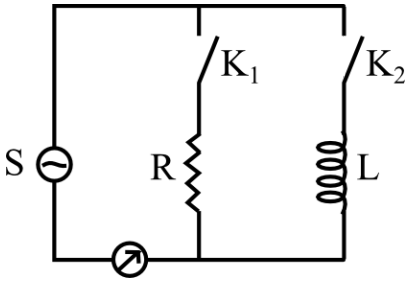
2. The figure below shows a 2.0 V potentiometer used for the determination of internal resistance of a 1.5 V cell. The balance point of the cell in the open circuit is 75 cm. When a resistor of $10\ \Omega$ is used in the external circuit of the cell, the balance point shifts to 65 cm length of potentiometer wire. Then the internal resistance of the cell is



(A) $2.5\ \Omega$ (B) $2.0\ \Omega$ (C) $1.54\ \Omega$ (D) $1.0\ \Omega$

Space for rough use

3. In the circuit shown here, R is a pure resistor, L is an inductor of negligible resistance (as compared to R), S is a 100 V, 50 Hz AC source of negligible resistance. With either key K_1 alone or K_2 alone closed, the current is I_0. If the source in changed to 100 V, 100 Hz,. the current with K_1 alone closed and with K_2 alone closed will be respectively,

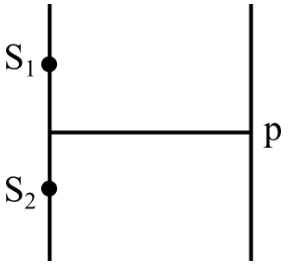


(A) $I_0,\ \frac{I_0}{2}$ (B) $I_0,\ 2I_0$ (C) $2I_0,\ I_0$ (D) $2I_0,\ \frac{I_0}{2}$

4. A plane electromagnetic wave of wave intensity 6 W/m^2 strikes a perfectly reflecting small mirror of area 30 cm^2, held perpendicular to the approaching wave. The momentum transferred in kg ms^{-1} by the wave to the mirror each second will be

(A) $1.2 \times 10^{-10}\ N$ (B) $2.4 \times 10^{-9}\ N$
(C) $3.6 \times 10^{-8}\ N$ (D) $4.8 \times 10^{-7}\ N$

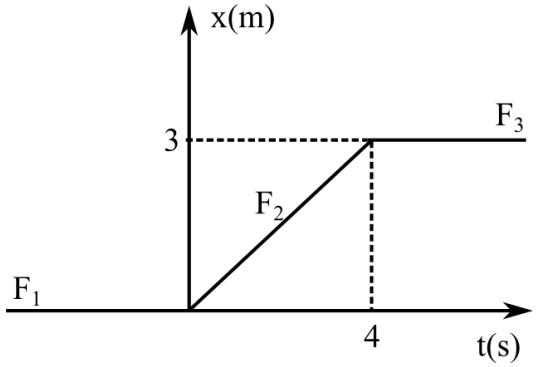
5. Coherent light is incident on two fine parallel slits S_1 and S_2 as shown in figure. If a dark fringe occurs at P, which of the following gives possible phase differences for the light waves arriving at P from S_1 and S_2 ?



(A) $2\pi, 4\pi, 6\pi, ...$ (B) $(1/2)\pi,\ (5/2)\pi,\ (9/2)\pi, ...$
(C) $\pi,\ 3\pi,\ 5\pi, ...$ (D) $(1/2)\pi,\ (3/2)\pi,\ (5/2)\pi, ...$

Space for rough use

6. Figure shows the position time graph of a particle of mass 4 kg. Let the force on the particle for t < 0, 0 <t < 4 s, t > 4 s be F_1, F_2 and F_3 respectviely. (Consider one dimensional motion only)

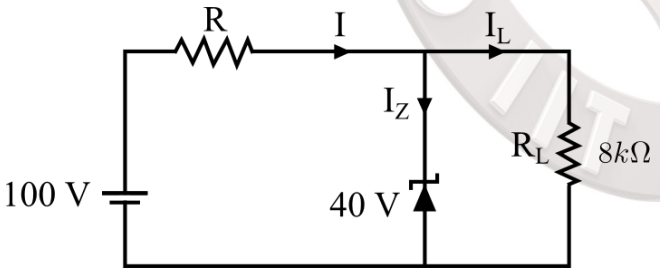


(A) $F_1 > F_2 > F_3$
(B) $F_1 < F_2 > F_3$
(C) $F_2 > F_1 = F_3$
(D) $F_1 = F_2 = F_3$

7. The mass, specific heat capacity and initial temperature of a sphere are 1000 gm, 1/2 cal/gm^o C and 80° C respectively. The mass of the liquid and the calorimeter are 900 gm and 200 gm, and initially both were at room temperature 20° C. Both calorimeter and the sphere are made of same material. If the steady - state temperature after mixing is found to be 40° C , then the specific heat capacity of unknown liquid is

(A) 0.25 cal/g^o C
(B) 0.5 cal/g^o C
(C) 1 cal/g^o C
(D) 1.5 cal/g^o C

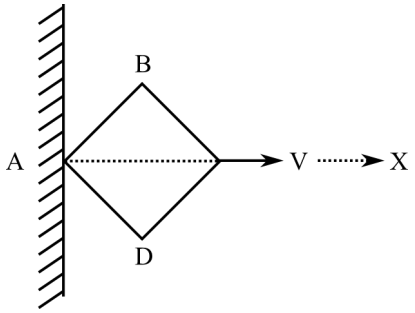
8. Figure shows zener diode with a breakdown voltage of 40 V connected to a 100 Volt D.C. source with a series resistance R and a load resistance (R_L). The output voltage across R_L is



(A) 40 V
(B) 20 V
(C) 50 V
(D) 60 V

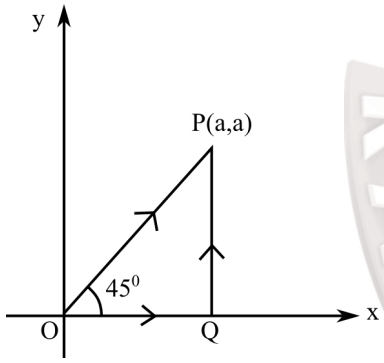
Space for rough use

9. Four rods each of length l have been hinged to form a rhombus. Vertex A is fixed to a rigid support, vertex C is being moved along the x - axis with a constant velocity v as shown in the figure. The rate at which vertex B is approaching the x - axis at the moment the rhombus is in the form of a square is



(A) $\frac{V}{4}$ (B) $\frac{V}{3}$ (C) $\frac{V}{2}$ (D) $\frac{V}{\sqrt{2}}$

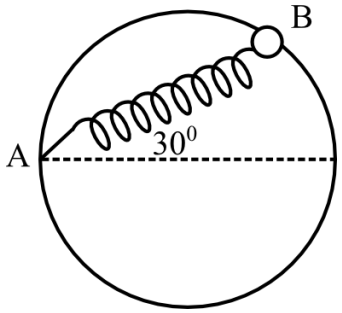
10. A particle is moved from (0, 0) to (a, a) under a force $\vec{F} = (3\hat{i} + 4\hat{j})$ along two paths. Path 1 is OP and path 2 is OQP. Let W_1 and W_2 be the work done by this force in these two paths. Then,



(A) $W_1 = W_2$ (B) $W_1 = 2W_2$ (C) $W_2 = 2W_1$ (D) $W_2 = 4W_1$

Space for rough use

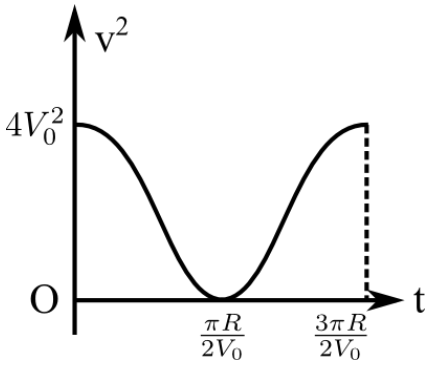
11. A bead of mass m is attached to one end of a spring of natural length R and spring constant $k = \frac{(\sqrt{3}+1)\,mg}{R}$. The other end of the spring is fixed at point A on a smooth vertical ring of radius R as shown in the figure. The normal reaction at B just after it is released to move is

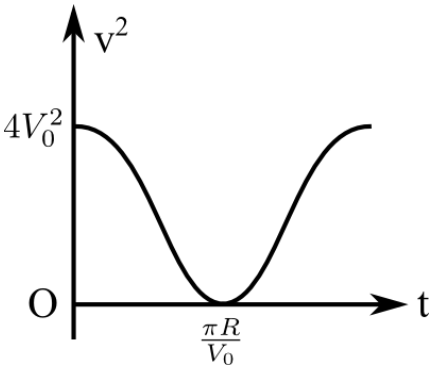


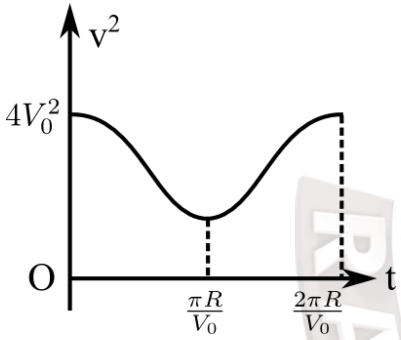
(A) $\frac{mg}{2}$ (B) $\sqrt{3}\,mg$ (C) $3\sqrt{3}$ (D) $\frac{3\sqrt{3}\,mg}{2}$

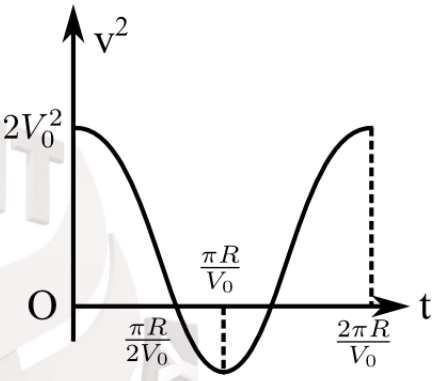
Space for rough use

12. A wheel is rolling without sliding on a horizontal surface. The centre of the wheel moves with a constant speed v_0. Consider a point P on the rim which is at the top at time t = 0. The square of speed of pont P is plotted against time t. The correct plot is (R is radius of the wheel)

(A)


(B)


(C)


(D)


13. A point P lies at a distance a from the centre C along the axis of a fixed ring of mass M and radius a. A small particle starts from P and reaches C under gravitational attraction only. Its speed at C will be

(A) $\sqrt{\frac{2GM}{a}}$

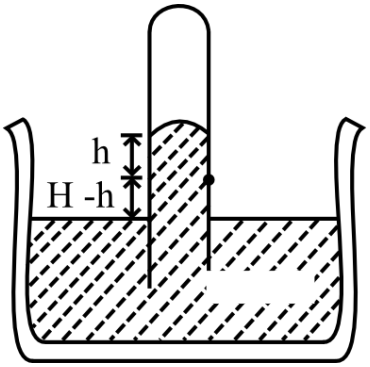
(B) $\sqrt{\frac{2GM}{a}\left(1-\frac{1}{\sqrt{2}}\right)}$

(C) $\sqrt{\frac{2GM}{a}(\sqrt{2}-1)}$

(D) zero

Space for rough use

14. Consider the barometer shown in figure. Density of mercury is ρ. A small hole is made at point S as shown. The mercury comes out from this hole with speed v equal to

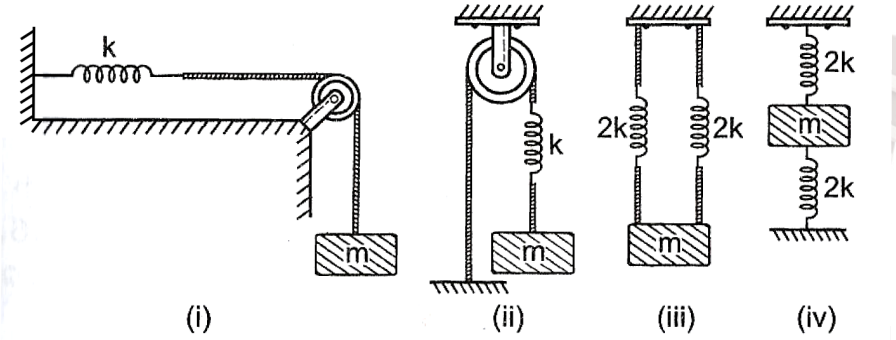


(A) $\sqrt{2gh}$
(B) $\sqrt{2gH}$
(C) $\sqrt{2g(H-h)}$
(D) None of these

15. A block of mass M is suspended from a thin wire of length L, area of cross - section A and Young's modulus Y. The elastic potential energy stored in the wire is

(A) $\frac{1}{2}\ \frac{M^2g^2L}{AY}$
(B) $\frac{1}{2}\ \frac{Mg}{ALY}$
(C) $\frac{1}{2}\ \frac{M^2g^2A}{YL}$
(D) $\frac{1}{2}\ \frac{MgY}{AL}$

16. A block of mass m is suspended by different springs of force constant shown in figure.



Let time period of oscillation in these four positions be T_1, T_2, T_3 and T_4. Then

(A) $T_1 = T_2 = T_4$
(B) $T_1 = T_2$ and $T_3 = T_4$
(C) $T_1 = T_2 = T_3$
(D) $T_1 = T_3$ and $T_2 = T_4$

Space for rough use

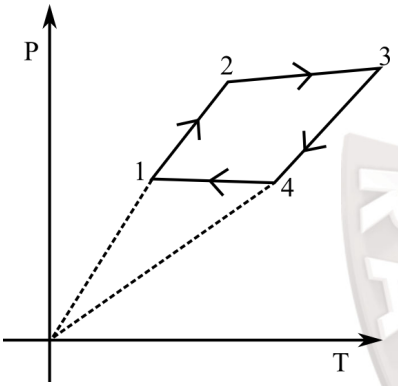
17. A string fixed at both ends is vibrating in the lowest mode of vibration for which a point at quarter of its length from one end is a point of maximum displacement. The frequency of vibration in this mode is 100 Hz. What will be the frequency emitted when it vibrates in the next mode such that this point is again a point of maximum displacement?

(A) 400 Hz (B) 200 Hz (C) 600 Hz (D) 300 Hz

18. A steel tape measures the length of a copper rod as 90.0 cm when both are at 10° C, the calibration temperature, for the tape. What would the tape read for the length of the rod when both are at 30° C. Given $\alpha_{\text{steel}} = 1.2 \times 10^{-5} per^0 C$ and $\alpha_{Cu} = 1.7 \times 10^{-5} per^0 C$

(A) 89.00 cm (B) 90.21 cm (C) 89.80 cm (D) 90.01 cn

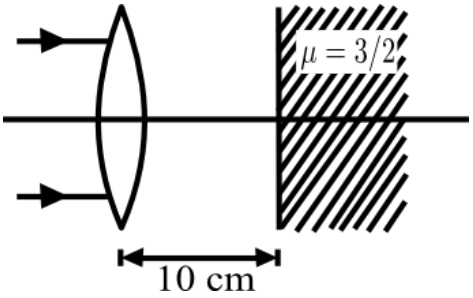
19. Three moles of an ideal monoatomic gas performs a cycle $1 \to 2 \to 3 \to 4 \to 1$ as shown. The gas temperatures in different states are, $T_1 = 400K, T_2 = 800K, T_3 = 2400K$ and $T_4 = 1200K.$ The work done by the gas during the cycle is (2 - 3 and 4 - 1 are isobaric)



(A) 1200 R (B) 3600 R (C) 2400 R (D) 2000 R

Space for rough use

20. Focal length of a thin convex lens is 30 cm. At a distance of 10 cm from the lens there is a plane refracting surface of refractive index 3/2. Where will the parallel rays incident on lens converge ?



(A) At a distance of 27.5 cm from the lens
(B) At a distance of 25 cm from the lens
(C) At a distance of 45 cm from the lens
(D) At a distance of 40 cm from the lens

Chemistry

Single Correct Questions +3 | -1

21. Which of the following waste materials can be used for producing bio-gas ?

(A) Thermocoal
(B) Glass bottle
(C) Tin Cans
(D) Paper scrap

22. The time required for 100% reaction completion for a zero order reaction in terms of rate constant (K) and initial Concentration (a_0) is :

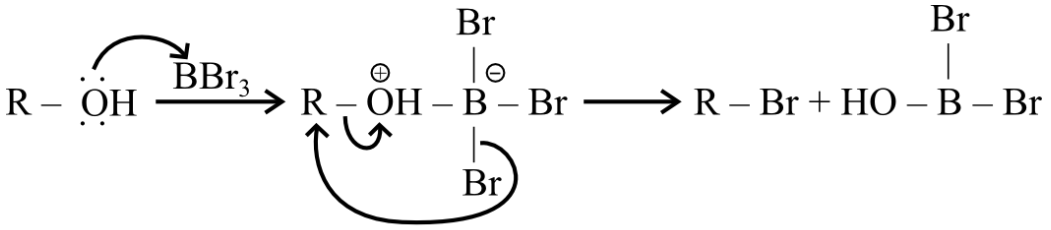
(A) $a_0 k$
(B) $\frac{a_0}{2k}$
(C) $\frac{a_0}{k}$
(D) $\frac{2k}{a_0}$

Space for rough use

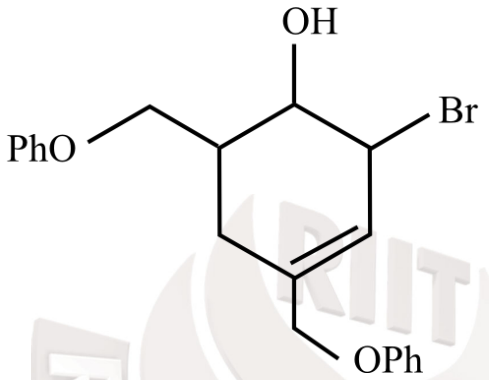
23. Consider the following reaction

Reaction : $-R-OH \xrightarrow{BBr_3} R-Br$

Mechanism : -

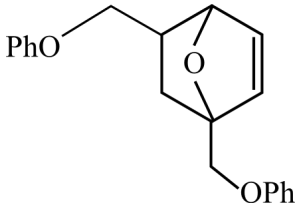


If A $\xrightarrow[\text{ii) } H_2O]{\text{i) } BBr_3}$

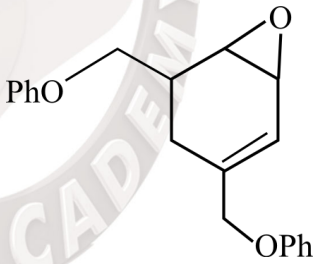


A can be

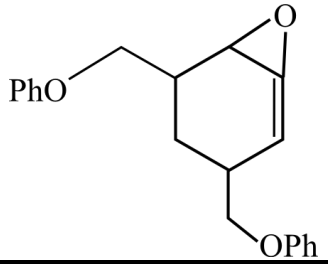
(A)



(B)



(C)



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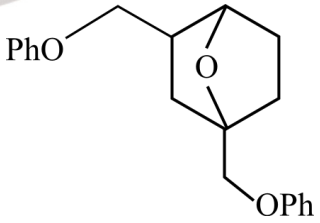
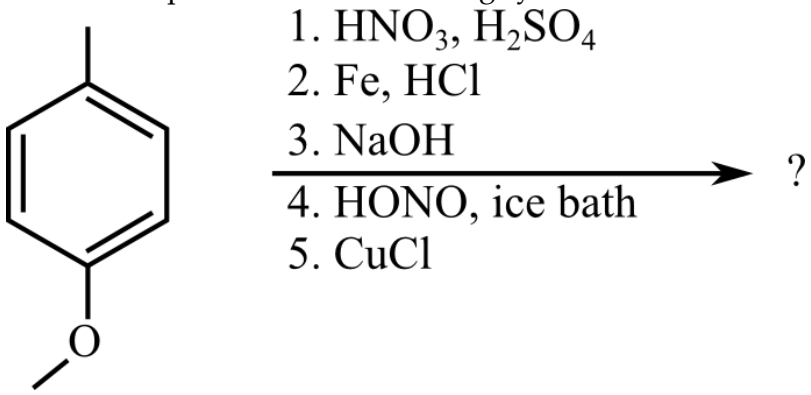


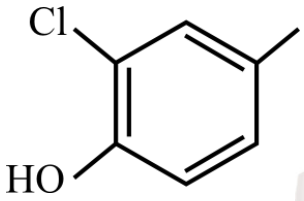
Space for rough use

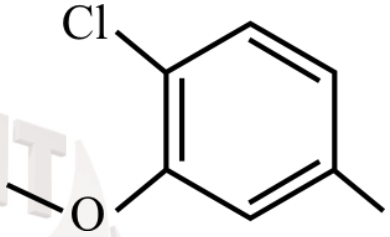
24. Which of the following electrolyte will heve maximum flocculation value for $Fe(OH)_3$ sol?

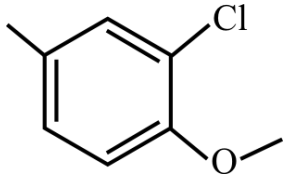
(A) $NaCl$ (B) Na_2S (C) $(NH_4)_3PO_4$ (D) K_2SO_4

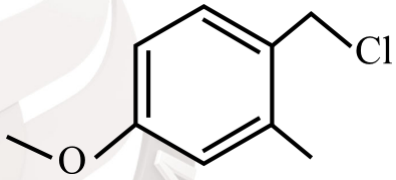
25. What is the product of the following synthesis ?



(A)


(B)


(C)


(D)


26. If the half - life of Radium is 1580 yr. Find the value of $t_{15/16}$ in years?

(A) 1580 years (B) 3160 years (C) 4740 years (D) 6320 years

27. Find the IUPAC symbol of Nuclie missing in the Nuclear reaction?

$^{235}_{92}U + ^{1}_{0}n + \longrightarrow ^{94}_{38}Sr + \text{———} + 3\ ^{1}_{0}n$

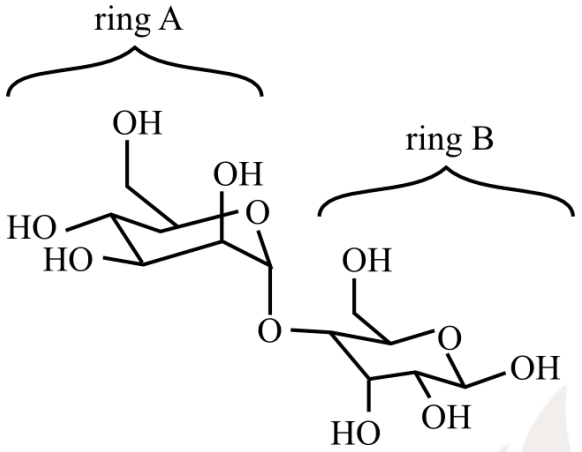
(A) $^{96}_{56}Ba$ (B) $^{90}_{36}Kr$ (C) $^{139}_{54}Xe$ (D) $^{226}_{88}Ra$

Space for rough use

28. The d- block metal ion in complex A has EAN value similar to the noble gas Krypton (Kr) then Find the complex A?

(A) $[Pd(NH_3)_6]Cl_4$
(B) $[Cr(NH_3)_5Cl]SO_4$
(C) $Na_4[Fe(CN)_6]$
(D) $K_3[Fe(CN)_6]$

29. Which statements are correct about the following disaccharide?



(A) Ring A is an acetal in the α configuration; ring B is a hemiacetal in the β configuration

(B) Ring A is an acetal in the β configuration; ring B is a hemiacetal in the α configuration

(C) Ring A is a hemiacetal in the α configuration; ring B is an acetal in the β configuration

(D) Ring A is a hemiacetal in the β configuration; ring B is an acetal in the α configuration

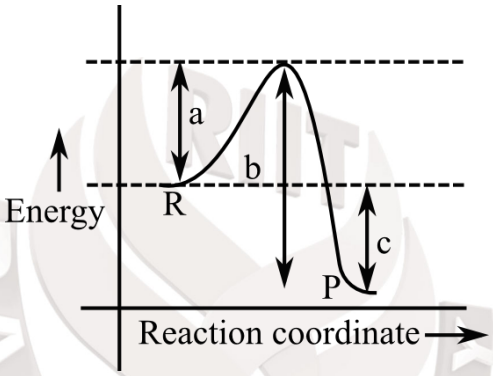
Space for rough use

30. Match the catalyst with their consequent industrial product?

	CATALYST		INDUSTRIAL OUTPUT
P	V_2O_5	i	High Density Polyethylene
Q	Zieglar - Natta	ii	Polyacrylonitrile
R	Peroxide	iii	NH_3
S	Finely divided Iron	iv	H_2SO_4

(A) P-(iv), Q-(i), R-(ii), S- (iii)
(B) P-(iv), Q-(iii), R-(ii), S- (i)
(C) P-(iii), Q-(i), R-(ii), S- (iv)
(D) P-(iv), Q-(ii), R-(i), S- (iii)

31. The Potential energy diagram for a reaction $R \longrightarrow P$ is given below: Find the activation energy required for the reverse reaction?

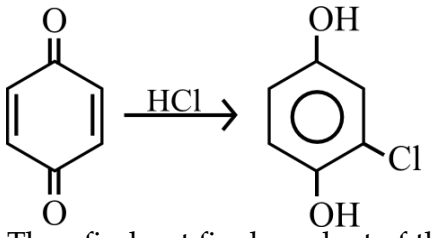


(A) a
(B) b-a
(C) a+b
(D) a+c

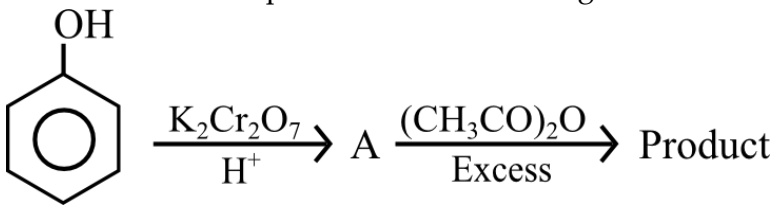
32. Which of the following pairs of elements cannot form an alloy?

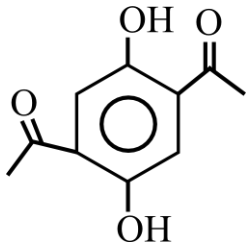
(A) Zn, Cu
(B) Fe, Hg
(C) Fe, C
(D) Hg, Na

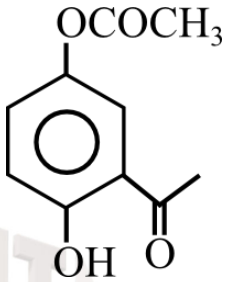
Space for rough use

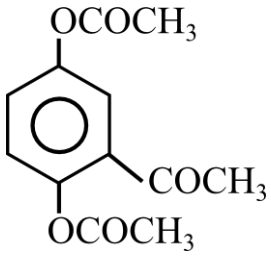
33. 

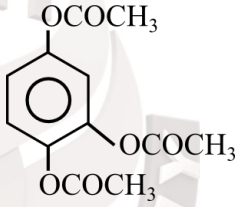
Then find out final product of the following reaction is



(A) 

(B) 

(C) 

(D) 

34. Which one of the following is the true covalent oxide of Iodine

(A) I_2O_7 (B) I_2O_9 (C) I_2O_4 (D) I_2O_5

35. The pyrimidine bases present in DNA are

(A) cytosine and thymine (B) cytosine and guanine

(C) cytosine and adenine (D) cytosine and uracil

Space for rough use

36. The rusting of Iron is catalysed by :

(A) Fe (B) O_2 (C) H^+ (D) Zn

37. What is the freezing point of a soliution containing 8.1g of HBr in 100g water assuming the acid to be 90% ionised? $(K_F(H_2O) = 1.86\ K\text{mol}^{-1})$

(A) 0.85^oC (B) -3.53^oC (C) 0^oC (D) -0.35^oC

38. Ripening of fruits can be carried out in the presence of chemical:

(A) Na_2SO_4 (B) CaC_2 (C) $NaCl$ (D) $CaCl_2$

39. Match the following with different concentration terms of H_2O_2 ?

	Column I		Column II
P	10 vol H_2O_2	1	perhydrol
Q	20 vol H_2O_2	2	5.358N
R	30 vol H_2O_2	3	1.785M
S	100 vol H_2O_2	4	3.03%

(A) p-4, Q-3, R-2, S-1 (B) p-1, Q-2, R-3, S-4

(C) p-1, Q-3, R-2, S-4 (D) p-4, Q-2, R-3, S-1

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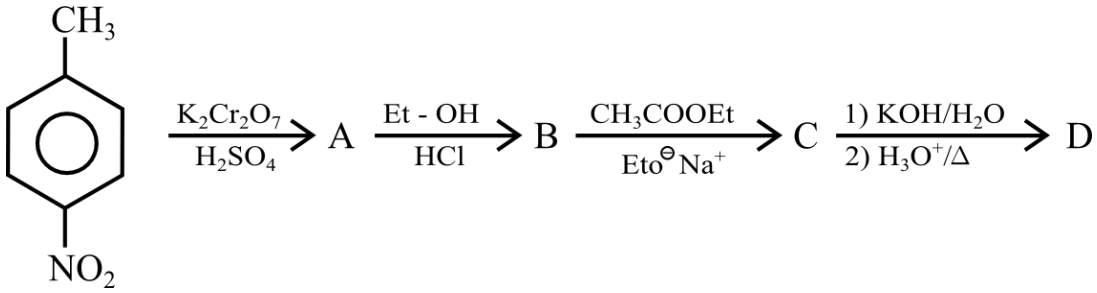
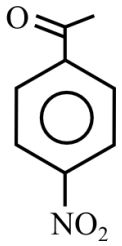
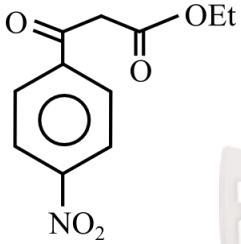
40. 

Incorrect statement is

(A) B is p - nitroester

(B) D is 

(C) C is 

(D) All are correct

Mathematics

Single Correct Questions +3 | -1

41. If the line $x\cos\theta + y\sin\theta = 2$ is the equation of a transerve common tangent to the circles $x^2 + y^2 = 4$ and $x^2 + y^2 - 6\sqrt{3}x - 6y + 20 = 0$, then the value of θ is :

(A) $\frac{5\pi}{6}$ (B) $\frac{2\pi}{3}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{6}$

Space for rough use

42. Given $A(0,0)$ and $B(x,y)$ with $x \in (0,1)$ and $y > 0$. Let the slope of the line AB eqauals m_1. Point C lies on the line x = 1 such that the slope of BC equals m_2 where $0 < m_2 < m_1$. If the area of the triangle ABC can be expressed as $(m_1 - m_2)f(x)$, then the largest possible value of $f(x)$ is

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

43. The maximum value of $(7\cos\theta + 24\sin\theta) \times (7\sin\theta - 24\cos\theta)$ for every $\theta \in R$.

(A) 25 (B) 625 (C) 625/2 (D) 625/4

44. $\frac{1}{2.4} + \frac{1.3}{2.4.6} + \frac{1.3.5}{2.4.6.8} + \frac{1.3.5.7}{2.4.6.8.10} + ...\infty$ is equal to

(A) $\frac{1}{4}$ (B) $\frac{1}{3}$ (C) $\frac{1}{2}$ (D) 1

45. The coefficient of $x^r (0 \le r \le n-1)$ in the expression :
$(x+2)^{n-1} + (x+2)^{n-2}.\ (x+1) + (x+2)^{n-3}.(x+1)^2 + ... + (x+1)^{n-1}$ is :

(A) ${}^nC_r(2^r - 1)$ (B) ${}^nC_r(2^{n-r} - 1)$
(C) ${}^nC_r(2^r + 1)$ (D) ${}^nC_r(2^{n-r} + 1)$

46. If $y = \frac{\cos 6x + 6\cos 4x + 15\cos 2x + 10}{\cos 5x + 5\cos 3x + 10\cos x}$, then $\frac{dy}{dx} =$

(A) $2\sin x + \cos x$ (B) $-2\sin x$ (C) $\cos 2x$ (D) $\sin 2x$

47. The area bounded by $y = 2 - |2 - x|$ and $y = \frac{3}{|x|}$ is :

(A) $\frac{4 + 3\ \ell n3}{2}$ (B) $\frac{4 - 3\ \ell n3}{2}$ (C) $\frac{3}{2} + \ell n3$ (D) $\frac{1}{2} + \ell n3$

Space for rough use

48. The solution of the differential equaiton, $xy\dfrac{dy}{dx} = \dfrac{1+y^2}{1+x^2}(1+x+x^2)$ given that when $x = 1, y = 0$ is

(A) $\ell n\sqrt{1+y^2} = \ell n\, x + \tan^{-1} x - \dfrac{\pi}{2}$

(B) $\ell n\dfrac{1+y^2}{x^2} = 2\tan^{-1} x - \dfrac{\pi}{2}$

(C) $\ell n\left(\dfrac{1+y^2}{x^2}\right) = \dfrac{\pi}{4} - 2\tan^{-1} x$

(D) None

49. If $x = \cos^{-1}(\cos 4)$; $y = \sin^{-1}(\sin 3)$ when which of the following holds ?

(A) $x - y = 1$

(B) $x + y + 1 = 0$

(C) $x + 2y = 2$

(D) $\tan(x+y) = -\tan 7$

50. The value of $\underset{x\to\infty}{\text{Limit}}\dfrac{\cot^{-1}(x^{-a}\log_a x)}{\sec^{-1}(a^x \log_x a)}(a > 1)$ is equal to

(A) 1

(B) 0

(C) $\pi/2$

(D) Does not exist

51. Let $f(x) = \dfrac{x}{1+x}$ and let $g(x) = \dfrac{rx}{1-x}$. Let S be the set of all real numbers r such that $f(g(x)) = g(f(x))$ for infinitely many real number x. The number of elements in set S is

(A) 1

(B) 2

(C) 3

(D) 5

52. Let $a = \lim\limits_{x\to 1}\ \dfrac{x}{\ell n\, x} - \dfrac{1}{x\ell n\, x}$; $b = \lim\limits_{x\to 0}\ \dfrac{x^3 - 16x}{4x + x^2}$; $c = \lim\limits_{x\to 0}\ \dfrac{\ell n(1+\sin x)}{x}$ and

$d = \lim\limits_{x\to -1}\ \dfrac{(x+1)^3}{3(\sin(x+1) - (x+1))}$, then the matrix $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is

(A) Idempotent

(B) Involutary

(C) Non singular

(D) Nilpotent

Space for rough use

53. Let $A = \begin{bmatrix} 1+x^2-y^2-z^2 & 2(xy+z) & 2(zx-y) \\ 2(xy-z) & 1+y^2-z^2-x^2 & 2(yz+x) \\ 2(zx+y) & 2(yz-x) & 1+z^2-x^2-y^2 \end{bmatrix}$ then det. A is equal to

(A) $(1+xy+yz+zx)^3$
(B) $(1+x^2+y^2+z^2)^3$
(C) $(xy+yz+zx)^3$
(D) $(1+x^3+y^3+z^3)^2$

54. If $\beta + 2\int_0^1 x^2 e^{-x^2} dx = \int_0^1 e^{-x^2}\, dx$ then the value of β is

(A) e^{-1}
(B) e
(C) 1/2e
(D) can not be determined

55. The evaluation of $\int \frac{px^{p+2q-1} - qx^{q-1}}{x^{2p+2q} + 2x^{p+q} + 1}\, dx$ is

(A) $-\frac{x^p}{x^{p+q}+1} + C$
(B) $\frac{x^q}{x^{p+q}+1} + C$
(C) $-\frac{x^q}{x^{p+q}+1} + C$
(D) $\frac{x^p}{x^{p+q}+1} + C$

56. Tangents are drawn from the point (-1, 2) on the parabola $y^2 = 4x$. The length, these tangents will intercept on the line x = 2 is :

(A) 6
(B) $6\sqrt{2}$
(C) $2\sqrt{6}$
(D) None of these

57. The chord PQ of the rectangular hyperbola $xy = a^2$ meets the axis of x at A; C is the mid point of PQ and 'O' is the origin. Then the ΔACO is :

(A) equilateral
(B) isosceles
(C) right angled
(D) right isosceles

Space for rough use

58. The line, $lx + my + n = 0$ will cut the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ in points whose eccentric angles differ by $\frac{\pi}{2}$ if :

(A) $a^2l^2 + b^2n^2 = 2m^2$
(B) $a^2m^2 + b^2l^2 = 2n^2$
(C) $a^2l^2 + b^2m^2 = 2n^2$
(D) $a^2n^2 + b^2m^2 = 2l^2$

59. The cost function at American Gadget is
$C(x) = x^3 - 6x^2 + 15x$ (x in thousands of units and x > 0)
The production level at which average cost is minimum is

(A) 2
(B) 3
(C) 5
(D) none

60. A horse runs along a circle with a speed of 20 km/hr . A lantern is at the centre of the circle . A fence is along the tangent to the circle at the point at which the horse starts . The speed with which the shadow of the horse move along the fence at the moment when it covers 1/8 of the circle in km/hr is

(A) 20
(B) 40
(C) 30
(D) 60

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ANSWERKEY

1.	A	2.	C	3.	A	4.	A
5.	C	6.	D	7.	C	8.	A
9.	C	10.	A	11.	D	12.	B
13.	B	14.	D	15.	A	16.	B
17.	D	18.	D	19.	C	20.	D
21.	D	22.	C	23.	A	24.	A
25.	C	26.	D	27.	C	28.	C
29.	A	30.	A	31.	D	32.	B
33.	D	34.	B	35.	A	36.	C
37.	B	38.	B	39.	A	40.	D
41.	D	42.	D	43.	C	44.	C
45.	B	46.	B	47.	B	48.	B
49.	D	50.	A	51.	B	52.	D
53.	B	54.	A	55.	C	56.	B
57.	B	58.	C	59.	B	60.	B