P33-16

Resonance®
Educating for better tomorrow

Code 0

ADVANCED PATTERN CUMULATIVE TEST-2 (ACT-2)

TARGET : JEE (MAIN+ADVANCED) 2017

PAPER-2 COURSE : VIJETA (ADP), VIJAY (ADR) Revision Plan-2

Date : 07-05-2017 Time: 3 Hours Maximum Marks : 240

Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.

GENERAL :

1. The sealed booklet is your Question Paper. Do not break the seal till you are instructed to do so.
2. The question paper CODE is printed on the right hand top corner of this sheet.
3. Use the Optical Response Sheet (ORS) provided separately for answering the question.
4. Blank spaces are provided within this booklet for rough work.
5. Write your Name and Roll Number in the space provided on the below cover.
6. After the open booklet, verify that the booklet contains all the **60** questions along with the options are legible.

QUESTION PAPER FORMAT AND MARKING SCHEME :

7. The question paper has three parts **: Mathematics, Physics and Chemistry.** Each part has **one** section.
8. Each section as detailed in the following table :

Section	Question Type	Number of Questions	Category-wise Marks for Each Question				Maximum Marks of the Section
			Full Marks	Partial Marks	Zero Marks	Negative Marks	
1	One or More Correct Option(s)	20	+4 If only the bubble(s) corresponding to all the correct option(s) is(are) darkened	+1 For darkening a bubble corresponding to each correct option, provided NO incorrect option is darkened	0 If none of the bubbles is darkened	–1 In all other cases	80

OPTICAL RESPONSE SHEET :

9. Darken the appropriate bubbles on the original by applying sufficient pressure.
10. The original is machine-gradable and will be collected by the invigilator at the end of the examination.
11. Do not tamper with or mutilate the ORS.
12. Write your name, roll number and the name of the examination centre and sign with pen in the space provided for this purpose on the original. **Do not write any of these details anywhere else**. Darken the appropriate bubble under each digit of your roll number.

DARKENING THE BUBBLES ON THE ORS :

13. Use a **BLACK BALL POINT** to darken the bubbles in the upper sheet.
14. Darken the bubble **COMPLETELY.**
15. Darken the bubble **ONLY** if you are sure of the answer.
16. The correct way of darkening a bubble is as shown here : ●
17. There is **NO** way to erase or "un-darkened bubble.
18. The marking scheme given at the beginning of each section gives details of how darkened and **not darkened** bubbles are evaluated.

NAME OF THE CANDIDATE : ……

ROLL NO. : ……

I have read all the instructions and shall abide by them

- -

Signature of the Candidate

I have verified the identity, name and roll number of the candidate.

- -

Signature of the Invigilator

DO NOT BREAK THE SEALS WITHOUT BEING INSTRUCTED TO DO SO BY THE INVIGILATOR

Resonance Eduventures Ltd.

CORPORATE OFFICE : CG Tower, A-46 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) - 324005

Ph.No. : +91-744-3012222, 6635555 **| Toll Free :** 1800 258 5555

Reg. Office : J-2, Jawahar Nagar, Main Road, Kota (Raj.) 324005 **| Ph. No.:** +91-744-3192222 **| FAX No. :** +91-022-39167222

Website : www.resonance.ac.in **| E-mail :** contact@resonance.ac.in | **CIN:** U80302RJ2007PLC024029

PART : I MATHEMATICS

SECTION – 1 : (Maximum Marks : 80)

- This section contains **TWENTY** questions
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
- For each question, marks will be awarded in one of the following categories :

Full Marks	:	+4	If only the bubble(s) corresponding to all the correct option(s) is(are) darkened.
Partial Marks	:	+1	For darkening a bubble corresponding to **each correct option,** provided NO incorrect option is darkened.
Zero Marks	:	0	If none of the bubbles is darkened.
Negative Marks	:	–1	In all other cases.

- For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will result in +4 marks ; darkening only (A) and (D) will result in +2 marks and darkening (A) and (B) will result in –1 marks, as a wrong option is also darkened.

1. Let x be a perfect square natural number. When x is divided by 5, the quotient is "q" and the remainder is "r" and $\sqrt{x}+r=q$ then check which of the following is/are correct?

(A) number of solution is 3

(B) number of solution is 2

(C) one of all solution is square of prime number

(D) the value of smallest solution is 25

2. Let $S_n=1-\frac{1}{2}+\frac{1}{3}-.....+(-1)^{n-1}\frac{1}{n}$ then which of the following is/are correct?

(A) $\frac{1}{n+1}+\frac{1}{n+2}+.....+\frac{1}{2n}=S_{2n}$

(B) $S_{2n}<1\ \forall n$

(C) $S_{2n}\geq 0.5\ \forall n$

(D) $0.5\leq S_n\leq 1\ \forall n$

Space for Rough Work

3. If in triangle ABC, $\overrightarrow{AB} = \frac{\vec{u}}{|\vec{u}|} - \frac{\vec{v}}{|\vec{v}|}$ and $\overrightarrow{AC} = \frac{2\vec{u}}{|\vec{u}|}$, where $|\vec{u}| \neq |\vec{v}|$, then

(A) $1 + \cos 2A + \cos 2B + \cos 2C = 0$ (B) $\sin A = \cos C$

(C) projection of AC on BC is equal to BC (D) projection of AB on BC is equal to AB

4. If $\vec{a} \times (\vec{b} \times \vec{c})$ is perpendicular to $(\vec{a} \times \vec{b}) \times \vec{c}$, Then which of the following may be correct ?

(A) $(\vec{a} \cdot \vec{c})|\vec{b}|^2 = (\vec{a} \cdot \vec{b})(\vec{b} \cdot \vec{c})$ (B) $\vec{a} \cdot \vec{b} = 0$

(C) $\vec{a} \cdot \vec{c} = 0$ (D) $\vec{b} \cdot \vec{c} = 0$

5. m and n are real numbers satisfying the equation $9m^2 + 2mn + n^2 - 92m - 20n + 244 = 0$, then

(A) $m \in [3, 6]$ (B) $m \in [1, 10]$ (C) $n \in [3, 6]$ (D) $n \in [1, 10]$

6. Let $\ell_1 = \lim\limits_{x \to \infty} \sqrt{\frac{x - \cos^2 x}{x + \sin x}}$, $\ell_2 = \lim\limits_{h \to 0^+} \int_{-1}^{1} \frac{h\,dx}{h^2 + x^2}$ and $\pi < \frac{22}{7}$ then

(A) both ℓ_1 and ℓ_2 are less than $\frac{22}{7}$

(B) one of the two limits is rational and other irrational.

(C) $\ell_2 > \ell_1$

(D) ℓ_2 is greater than 3 times of ℓ_1.

Space for Rough Work

7. Let $f : R \to R$ defined by $f(x) = \cos^{-1}(-\{-x\})$

where $\{x\}$ is fractional part function. Then which of the following is/are correct?

(A) f is many one but not even function.

(B) Range of f contains two prime numbers.

(C) f is aperiodic.

(D) Graph of f does not lie below x–axis.

8. If f(x) is continuous and derivable $\forall\ x \in R$ and $f'(c) = 0$ for exactly 2 real values of 'c' then the number of real and distinct values of 'd' for which $f(d) = 0$ can be

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

9. Consider the function $f : R \to R$ defined as $f(x) = x + \sin x$. Which of the following is/are the correct statement(s)?

(A) The function is strictly increasing at every point on R except at 'x' equal to an odd integral multiple of π where the derivative of f (x) is zero and where the function f is not strictly increasing.

(B) The function is bounded in every bounded interval but unbounded on whole real line.

(C) The graph of the function $y = f(x)$ lies in the first and third quadrants only.

(D) The graph of the function $y = f(x)$ cuts the line $y = x$ at infinitely many points.

Space for Rough Work

10. If $f(x) = \begin{cases} \sin x & x \text{ is rational} \\ \cos x & x \text{ is irrational} \end{cases}$, then $y = f(x)$ is

(A) discontinuous at $x = n\pi + \frac{\pi}{4}$ for some $n \in I$ (B) continuous at $x = n\pi + \frac{\pi}{4}$ for $\forall\ n \in I$

(C) discontinuous $\forall\ x \in R$ (D) discontinuous at $x = \frac{3\pi}{4}$

11. Let $(a - 1)(x^2 + \sqrt{3}x + 1)^2 - (a + 1)(x^4 - x^2 + 1) \leq 0\ \ \forall\ x \in R$, then which of the following is/are correct?

(A) $a \in \left[-\frac{1}{\sqrt{3}}, \frac{4}{\sqrt{3}}\right]$ (B) Largest possible value of a is $\sqrt{3}$

(C) Number of possible integral values of a is 3 (D) Sum of all possible integral values of a is '0'

12. Let a, b, c and $m \in R^+$. Possible value of m (independent of a, b and c) for which atleast one of the following equations $\left.\begin{array}{l} ax^2 + bx + cm = 0 \\ bx^2 + cx + am = 0 \\ cx^2 + ax + bm = 0 \end{array}\right\}$ have real roots is

(A) $\frac{1}{12}$ (B) $\frac{1}{8}$ (C) $\frac{1}{4}$ (D) $\frac{1}{2}$

Space for Rough Work

13. Let $(\log_2 x)^2 - 4\log_2 x - m^2 - 2m - 13 = 0$ be an equation in x and $m \in R$, then which of the following must be correct?

(A) For any $m \in R$, the equation has two distinct solutions.

(B) The product of the solutions of the equation does not depend on m.

(C) One of the solutions of the equation is less than 1 while the other is greater than 1 for $\forall\ m \in R$.

(D) The minimum value of the larger solution is 2^6 and maximum value of the smaller solution is 2^{-2}.

14. Let $f(x) = \min\{x^3, x^2\}$ and $g(x) = [x]^2 + \sqrt{\{x\}^2}$, where [x] denotes the greatest integer and {x} denotes the fractional part function. Then which of the following holds?

(A) f is continuous for all x.

(B) g is discontinuous for all $x \in I$.

(C) f is differentiable for all $x \in (1, \infty)$

(D) g is not differentiable for all $x \in I$

15. Assume that $\lim_{\theta \to -1} f(\theta)$ exists and $\frac{\theta^2 + \theta - 2}{\theta + 3} \le \frac{f(\theta)}{\theta^2} \le \frac{\theta^2 + 2\theta - 1}{\theta + 3}$ holds for certain interval containing the point $\theta = -1$ then $\lim_{\theta \to -1} f(\theta)$

(A) is equal to f (–1) (B) is equal to 1 (C) does not exist (D) is equal to – 1

16. If $\sqrt{y + x} + \sqrt{y - x} = c$ (where $c \neq 0$), then $\frac{dy}{dx}$ has the value equal to

(A) $\frac{2x}{c^2}$ (B) $\frac{x}{y + \sqrt{y^2 - x^2}}$ (C) $\frac{y - \sqrt{y^2 - x^2}}{x}$ (D) $\frac{c^2}{2y}$

Space for Rough Work

17. For the function $y = f(x) = (x^2 + bx + c)e^x$, which of the following holds?

(A) if $f(x) > 0$ for all real $x \not\Rightarrow f'(x) > 0$

(B) if $f(x) > 0$ for all real $x \Rightarrow f'(x) > 0$

(C) if $f'(x) > 0$ for all real $x \Rightarrow f(x) > 0$

(D) if $f'(x) > 0$ for all real $x \not\Rightarrow f(x) > 0$

18. Let $f(x) = x^2 - |x|$, $\forall\ x \in R$, be a real valued function from $f : R \to R$. Let $g(x) = f(x) + |f(x)|$ then, **INCORRET** statements is/are

(A) $g(x) = 0\ \ \forall\ x \in [-2, 2]$

(B) $g(\alpha) = g(\beta)$ if and only if $\alpha = \beta$

(C) Let α and β be roots of equation $g(x) = 0$, then least value of $\alpha + \beta$ is -2 and maximum value of $\alpha + \beta$ is 2. (where α and β need not to be distinct)

(D) f(x) is one-one

19. $f(x) = |(x^2 - ax + 2)(x^2 - px + 4)|$, $x \in R$, $a, p \in R$. Let number of points where f(x) is non-derviable be n, hence

(A) If $n = 4$ then $a^2 > 8$ and $p^2 > 16$

(B) if $a^2 > 8$ and $p^2 > 16$, then $n = 4$

(C) n cannot be equal to 3

(D) If $n = 2$ and $a = 3$, then $p \in \{5\} \cup (-4, 4)$

20. If $f(x) = (\sin^2 x - 1)^n (2 + \cos^2 x)$, $(n \in N)$ then $x = \frac{\pi}{2}$ is a point of

(A) Local maximum, if n is odd

(B) Local minimum if n is odd

(C) Local minimum, if n is even

(D) Local maxima for all n

Space for Rough Work

PART - II : PHYSICS

SECTION – 1 : (Maximum Marks : 80)

- This section contains **TWENTY** questions
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
- For each question, marks will be awarded in one of the following categories :

Full Marks	:	+4	If only the bubble(s) corresponding to all the correct option(s) is(are) darkened.
Partial Marks	:	+1	For darkening a bubble corresponding to **each correct option,** provided NO incorrect option is darkened.
Zero Marks	:	0	If none of the bubbles is darkened.
Negative Marks	:	–1	In all other cases.

- For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will result in +4 marks ; darkening only (A) and (D) will result in +2 marks and darkening (A) and (B) will result in –1 marks, as a wrong option is also darkened.

21. A fusion reaction consists of combining four protons into an α–particle. The mass of α–particle is 4.002603u and that of proton is 1.007825u, mass of electron is 0.00054466u

(A) the equation $4p_1^1 \rightarrow He_2^4$ does not satisfy conservation of charge

(B) the correct reaction equation may be $4p_1^1 \rightarrow He_2^4 + 2\beta^+ + 2\upsilon$ where β^+ is positron and υ is the neutrino (zero rest mass and uncharged)

(C) loss of mass in the reaction is 0.027608 u

(D) the energy equivalent of the mass defect is 25.7 MeV

Space for Rough Work

22. Consider white light whose wavelength spread is from 400nm to 700nm. Its energy is uniformly distributed in this spectrum. The light is incident on a metal A of work function 1.55eV. Saturation photo current is 6mA. Now the same light is incident on metal B, work function 2.48eV. Choose the correct options. [Take hc = 1240 eV nm. Assume photo efficiency remains same]

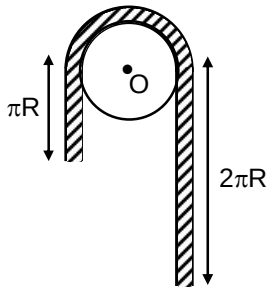
(A) Stopping potential for experiment with metal A is 0.22 V

(B) Stopping potential for experiment with metal B is 0.62 V

(C) Saturation photo current for metal B will be 2mA

(D) Saturation photo current for metal B will be $\frac{18}{11}$ mA

23. Consider a rope of mass 4m and length $4\pi R$ on a fixed rough pulley of radius R as shown in the figure. The rope is in equilibrium. Length of vertical hanging parts is shown in the figure.



(A) Torque of friction force about O on pulley is 4mgR

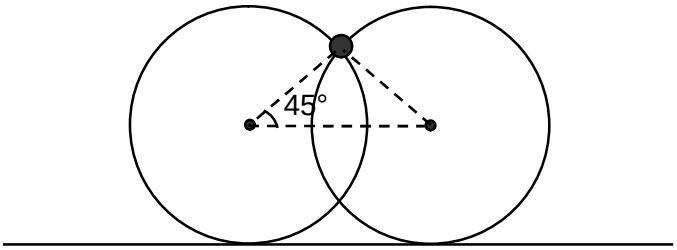
(B) Torque of normal force between rope and pulley on pulley about O is zero

(C) Torque of friction force between rope and pulley on pulley about O is mgR

(D) Torque of friction force between rope and pulley on pulley about O is zero

Space for Rough Work

24. Two identical uniform large rings each of mass m are connected through a bead of same mass, which can move freely. When bead is released it starts sliding down. The large rings roll apart over a sufficiently rough horizontal surface. Whole system is released from rest as shown in figure. Choose the correct Option(s). (Neglect friction between bead and large rings)



(A) Acceleration of the bead at the initial moment is $\frac{g}{9}$.

(B) Acceleration of the bead at the initial moment is $\frac{g}{5}$.

(C) At the initial moment normal contact between bead and any of the ring is $\frac{4\sqrt{2}mg}{9}$.

(D) Normal contact between bead and any of the ring is $\frac{2\sqrt{2}mg}{5}$.

Space for Rough Work

25. A particle travels along the path $y = a + bx + cx^2$ where a, b, c are positive constants. If v_0 is the speed of the particle and it is constant. Then choose the correct options, if at the given instant particle is at x = 0.

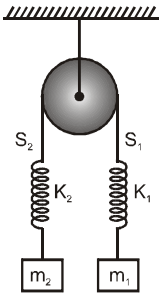
(A) radius of curvature is $\frac{(1+b^2)^{3/2}}{2c}$

(B) magnitude of net acceleration is $\frac{2cv_0^{\,2}}{\left(1+b^2\right)^{3/2}}$

(C) radius of curvature is $\frac{2c^2v_0^{\,2}}{\left(1+b^2\right)^{3.2}}$

(D) magnitude of centriptal acceleration $\frac{v_0^{\,2}}{1+b^2}$

26. Consider the condition shown in the figure. Pulley is massless and frictionless, springs are massless. Both the blocks are released with the springs in their natural lengths. Choose the correct options.



(A) Maximum elongation in the spring S_1 is $\frac{4m_1m_2g}{K_1(m_1+m_2)}$

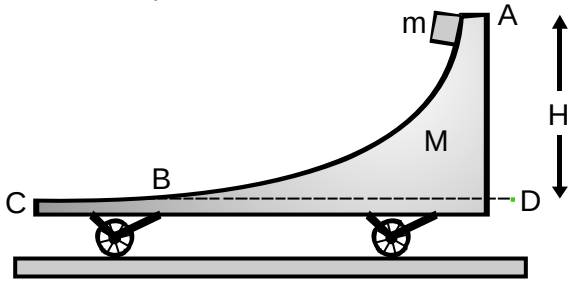
(B) Maximum elongation in the spring S_1 is $\frac{4m_1m_2g}{K_2(m_1+m_2)}$

(C) If $m_1 = m_2$ both the blocks will come to instantaneous rest simultaneously.

(D) If $K_1 = K_2$ both the blocks will come to instantaneous rest simultaneously.

Space for Rough Work

27. A toy cart of mass M is kept on a horizontal frictionless table. The top surface of the cart is as shown in figure below. A small block of mass m is at A. Initially the system is at rest block of mass m is released from A and it slides on the cart without friction. AD = H and horizontal portion BC = L, then choose the correct options.



(A) Maximum velocity of cart with respect to block is $\sqrt{\frac{2gH(M+m)}{M}}$

(B) Maximum velocity of cart with respect to block is $\sqrt{\frac{2gH(M+m)}{m}}$

(C) Time taken by the block to travel from B to C is $L\sqrt{\frac{M}{(M+m)2gH}}$

(D) Time taken by the block to travel from B to C is $L\sqrt{\frac{m}{(M+m)2gH}}$

28. Two uniform concentric coil of radii r_1 and r_2 ($r_1 << r_2$) carry currents i_1 and i_2 respectively. If the smaller coil is rotated slightly about one of its diameter it starts oscillating. Then choose the correct statements.

(A) The oscillations are simple harmonic in nature

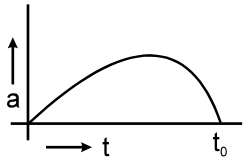
(B) The frequency of oscillation is directly proportional to product $i_1 i_2$.

(C) The frequency of oscillation is directly proportional to square root of r_2.

(D) The frequency of oscillation is independent of radius r_1.

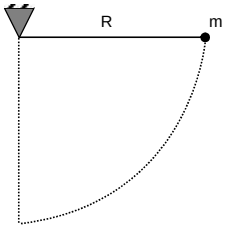
Space for Rough Work

29. A particle is moving in a straight line whose acceleration versus time graph is given. Assume that initial velocity is in the direction of acceleration. Then which of the statement(s) is/are correct between time t = 0 to t = t_0.



(A) Velocity first increases then decreases, displacement always increases
(B) Total change in velocity during the given interval is zero.
(C) Displacement always increases
(D) Velocity always increases

30. A small ball of mass m is attached at one end of a thread. The thread is held taut and horizontal, and the ball is released from this position.



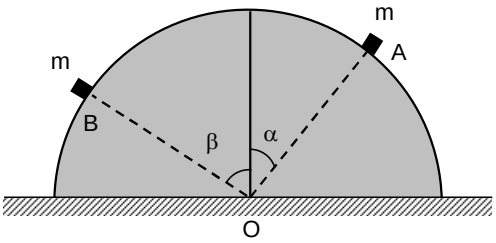
(A) Angle between thread and vertical when the tension in thread is equal to weight in magnitude is $\cos^{-1}(1/3)$.
(B) Angle between the thread and vertical when the net acceleration becomes horizontal for mass m is $\tan^{-1}(\sqrt{2})$

(C) speed of ball when tension in thread is equal to weight of ball is $\sqrt{\frac{2gR}{3}}$

(D) speed of ball when net acceleration of ball is horizontal is $\sqrt{\frac{2gR}{3}}$

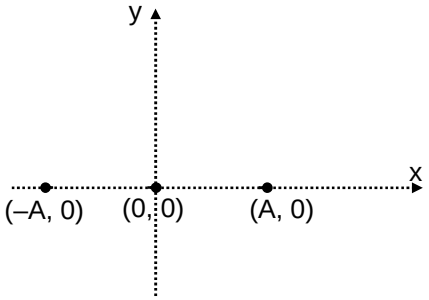
Space for Rough Work

31. A solid hemisphere is placed on a rough horizontal surface. Two small blocks each of mass m are placed on the hemisphere as shown in figure. Blocks remain in equilibrium. If ($\beta > \alpha$) then select correct statements.



(A) Contact force on A is greater then contact force on B.
(B) The force of friction on hemisphere from ground is towards left.
(C) The torque on hemisphere due normal from ground about O is mgR ($\sin\beta - \sin\alpha$)
(D) The torque on hemisphere due normal from ground about O is zero.

32. A charged particle (+q) is moving simple harmonically on the x-axis with its mean position at origin. Amplitude of the particle is A and its angular frequency is ω.



(A) The magnitude of magnetic field at (2A, 0) will change periodically with period $2\pi/\omega$.

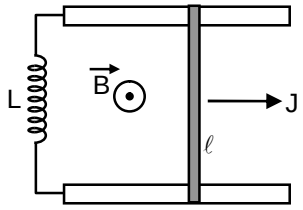
(B) The maximum magnitude of the magnetic field at (0, A) is $\frac{\mu_0}{4\pi}\cdot\frac{q\omega}{A}$

(C) The magnitude of magnetic field at (A, A) at the moment the particle passes through $\left(\frac{A}{2}, 0\right)$, will be $\frac{\sqrt{3}\cdot\mu_0 q\omega}{5\sqrt{5}\pi A}$

(D) The magnitudes of magnetic field at (0, A) and (0, –A) will be same at any time.

Space for Rough Work

33. Two parallel resistance less rails are connected by an inductor of inductance L at one end as shown in the figure. A magnetic field B exists in the space which is perpendicular to the plane of the rails. Now a conductor of length ℓ, mass m and neglible resistance is placed transverse on the rails and given an impulse J towards the rightward direction. Then choose the correct option (s).



(A) Velocity of the conductor is half of the initial velocity after a displacement of the conductor $d = \sqrt{\frac{3J^2L}{4B^2\ell^2m}}$

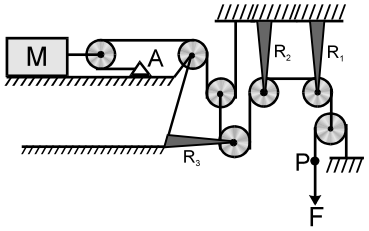
(B) Current flowing through the inductor at the instant when velocity of the conductor is half of the initial velocity is $i = \sqrt{\frac{3J^2}{4Lm}}$

(C) Velocity of the conductor is half of the initial velocity after a displacement of the conductor $d = \sqrt{\frac{3J^2L}{B^2\ell^2m}}$

(D) Current flowing through the inductor at the instant when velocity of the conductor is half of the initial velocity is $i = \sqrt{\frac{3J^2}{Lm}}$

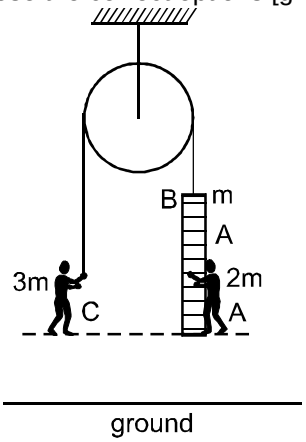
Space for Rough Work

34. In the given arrangement, mass of the block is M and the surface on which the block is placed is smooth. Assuming all pulleys to be massless and frictionless, strings to be inelastic and light, R_1, R_2 and R_3 to be light supporting rods, then acceleration of point 'P' will be (A is fixed) :



(A) 0 (B) ∞ (C) $\frac{4F}{m}$ (D) $\frac{2F}{m}$

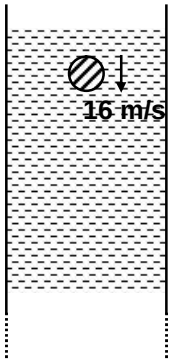
35. Man A of mass 2m is standing on a ladder of mass m. Ladder is attached with an inextensible light string and man C of mass 3m is holding the other end of string. Initially, the whole system is at rest. Assume whole system is at sufficient height and pulley is frictionless. Also A and C are at same horizontal level. Then choose the correct options.[g = 10 m/s^2].



(A) If man A starts climbing up on the ladder with a constant acceleration of 4 m/s^2 w.r.t ground then, the vertical distance between A and C after 1 sec is 1 m.
(B) If man C starts climbing up on the rope (while A remain at rest with respect to ladder) with constant acceleration of 4 m/s^2 with respect to ground then, the vertical distance between A and C after 1 sec is 2 m.
(C) If both man A and C starts climbing up with constant acceleration 4 m/s^2 with respect to ground then, acceleration of ladder is 4 m/s^2 upward .
(D) If both man A and C starts climbing up with constant acceleration 4 m/s^2 with respect to ground then, acceleration of ladder is 3 m/s^2 upward .

Space for Rough Work

36. In a tall viscous liquid column in gravity free space, a solid ball is projected with 16 m/s as shown at t = 0. Velocity of the ball reduces to 1 m/s at t = 4s.



(A) Velocity of ball at t = 1s is 8 m/s

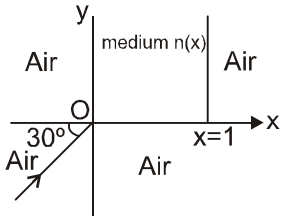
(B) Velocity of ball at t = 3s is 2 m/s

(C) If F_1 is average viscous force acting on the ball between t = 0 and t = 2s and F_2 is average viscous force on the ball between t = 2 and t = 4, then value of $\frac{F_1}{F_2}$ is 4.

(D) If F_1 is average viscous force acting on the ball between t = 0 and t = 2s and F_2 is average viscous force on the ball between t = 2 and t = 4, then value of $\frac{F_1}{F_2}$ is 3.

Space for Rough Work

37. A light ray enters into a medium whose refractive index varies along the x-axis as $n(x) = n_0\sqrt{1+\frac{x}{4}}$ where $n_0 = 1$. The medium is bounded by the planes x = 0, x = 1 & y = 0. If the ray enters at the origin at an angle 30º with x–axis.



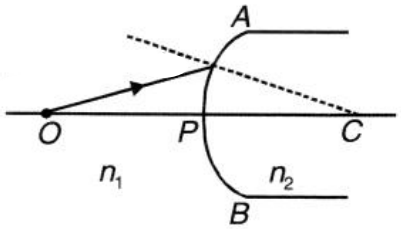
(A) equation of trajectory of the light ray is $y = [\sqrt{3+x} - \sqrt{3}\,]$

(B) equation of trajectory of the light ray is $y = 2[\sqrt{3+x} - \sqrt{3}\,]$

(C) the coordinates of the point at which light ray comes out from the medium is $[1, 2(2-\sqrt{3}\,)]$

(D) the coordinates of the point at which light ray comes out from the medium is $[1, (2-\sqrt{3}\,)]$

38. A point object is kept at a distance of $OP = u$. The radius of curvature of spherical surface APB is $CP = R$. The refractive index of the media are n_1 and n_2 which are as shown in the diagram, then (consider only paraxial rays)



(A) If $n_1 > n_2$ image is virtual for all values of u

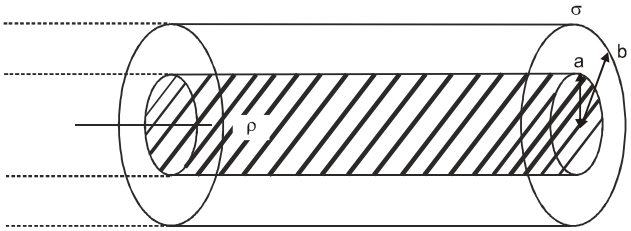
(B) If $n_2 = 2n_1$ image is virtual when $R > u$

(C) The image is real for all values of u, n_1 and n_2

(D) If $n_2 > n_1$ then image will be always real

Space for Rough Work

39. A long co-axial cable carries a uniform volume charge density ρ on inner cylinder and uniform surface charge density σ on outer cylinder. If radius of inner cylinder is 'a' and radius of outer cylinder is 'b'. It is found that this infinite cable is electrically neutral then which of the following is/are correct.



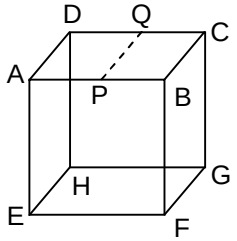
(A) $\frac{\sigma}{b^2}+\frac{\rho}{2a}=0$

(B) $\frac{\sigma}{a^2}+\frac{\rho}{2b}=0$

(C) Electric field outside the cable increases linearly with radial distance

(D) Electric field will be zero outside the cable

40. Consider an imaginary cube of side 'ℓ' as shown in figure :



An infinite large sheet of surface charge density σ passes through PQGF. P and Q are mid points of AB and DC respectively. Out of six faces of cube the electric flux linked :

(A) is zero with three faces

(B) with face ADHE and face BCGF are equal

(C) is minimum (non zero) with FGHE

(D) is zero with two faces

Space for Rough Work

PART - III : CHEMISTRY

Atomic masses : [H = 1, D = 2, Li = 7, C = 12, N = 14, O = 16, F = 19, Na = 23, Mg = 24, Al = 27, Si = 28, P = 31, S = 32, Cl = 35.5, K = 39, Ca = 40, Cr = 52, Mn = 55, Fe = 56, Cu = 63.5, Zn = 65, As = 75, Br = 80, Ag = 108, I = 127, Ba = 137, Hg = 200, Pb = 207]

SECTION – 1 : (Maximum Marks : 80)

- This section contains **TWENTY** questions
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
- For each question, marks will be awarded in one of the following categories :

Full Marks	:	+4	If only the bubble(s) corresponding to all the correct option(s) is(are) darkened.
Partial Marks	:	+1	For darkening a bubble corresponding to **each correct option,** provided NO incorrect option is darkened.
Zero Marks	:	0	If none of the bubbles is darkened.
Negative Marks	:	–1	In all other cases.

- For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will result in +4 marks ; darkening only (A) and (D) will result in +2 marks and darkening (A) and (B) will result in –1 marks, as a wrong option is also darkened.

41. Which of the following reaction(s) is/are used in the preparation of colloidal solution?

(A) $AuCl_3 + SnCl_2 \rightarrow Au + SnCl_4$

(B) $As_2O_3 + H_2S \rightarrow As_2S_3 + H_2O$

(C) $H_2S + SO_2 \rightarrow S + H_2O$

(D) $FeCl_3 + H_2O \rightarrow Fe(OH)_3 + HCl$

Space for Rough Work

42. Which reaction(s) is/are not relevant in production of sodium carbonate by ammonia-soda process?

(A) $2NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + CO_2 + H_2O$

(B) $NaCl + NH_4HCO_3 \longrightarrow NaHCO_3 + NH_4Cl$

(C) $2NH_3 \xrightarrow{\Delta} N_2 + 3H_2$

(D) $NH_4Cl + Ca(OH)_2 \longrightarrow 2NH_3 + CaCl_2 + 2H_2O$

43. Which of the following reaction(s) takes place in the Bessemer converter for the extraction of Cu?

(A) $2CuFeS_2 + 4O_2 \rightarrow Cu_2S + 2FeO + 3SO_2$

(B) $CuS + 2O_2 \rightarrow CuO + SO_3$

(C) $Cu_2S + 2Cu_2O \rightarrow 6Cu + SO_2$

(D) $FeO + SiO_2 \rightarrow FeSiO_3$

44. An equimolar mixture of benzene & toluene is prepared. The total vapour pressure of this mixture as fraction of mole of benzene is found to be $P_T = 200 + 400\ X_{benzene}$ mm of Hg. Than :

(A) Pure state vapour pressure of benzene is 600 mm of Hg.

(B) Pure state vapour pressure of toluene is 200 mm of Hg.

(C) Ratio of mole fraction of benzene and toluene in vapour phase after 5 times fractional distillation is $2^5 : 1$.

(D) Ratio of mole fraction of benzene and toluene in vapour phase after 5 times fractional distillation is $3^5 : 1$.

Space for Rough Work

45. A quantity of 720 g water is added in 230 g ethanol at a certain temperature to get 1L of solution. Which of the following is/are correct regarding the solution formed?

(A) The density of solution is 950 kg/m^3.

(B) The mole fraction of ethanol is 0.11.

(C) The molarity of solution is 5 M.

(D) The molality of solution is 6.94 m.

46. Assuming that only particles emitted during natural radioactive decay are alpha and beta particles, which of the following atoms could not possibly result from the natural decay of $_{92}U^{235}$ atoms?

(A) $_{90}Th^{231}$ (B) $_{89}Ac^{227}$ (C) $_{89}Ac^{235}$ (D) $_{82}Pb^{207}$

47. Which of the following description of solid is incorrect?

(A) AlN : Ionic solid

(B) SiC : Covalently bonded network solid

(C) ZnS : Covalently bonded network solid

(D) Buckminster fullerene : Molecular solid

48. Which order of atomic/ionic radii is (are) correct?

(A) $F^- > H^-$ (B) $F^- > Na^+$ (C) $H^+ < Li^+$ (D) Y < La

Space for Rough Work

49. Which reaction will evolve O_2 gas as one of the products?

(A) $MnO_4^- + H_2O_2 \xrightarrow{H^+}$ (B) $Ce^{4+} + H_2O_2 \longrightarrow$

(C) $SnCl_2 + H_2O_2 \longrightarrow$ (D) $K_4[Fe(CN)_6] + H_2O_2 \xrightarrow{H^+}$

50. Nitrogen dioxide gas can oxidise

(A) HCl (B) HBr (C) CO (D) HF

51. Select the correct statement (s)

(A) $EDTA^{4-}$ can strongly coordinate to Ca^{2+}.

(B) $EDTA^{4-}$ can strongly coordinate to Be^{2+}.

(C) Biscyclopentadienyliron(II) is an organometallic compound.

(D) $K_4[Fe(CN)_6]$ is an organometallic compound.

52. The equilibrium constant K_p for the reaction,

$$SO_2Cl_2(g) \rightleftharpoons SO_2(g) + Cl_2(g)$$

is 1.125 atm at temperature T. Select the correct statement(s) for dissociation of pure SO_2Cl_2 (g) at equilibrium state at 2 atm equilibrium pressure and temperature T :

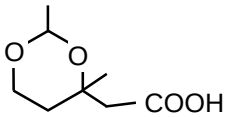
(A) degree of dissociation of SO_2Cl_2 is 0.5

(B) degree of dissociation of SO_2Cl_2 is 0.6

(C) average molar mass of final equilibrium mixture is approximately 84 g/mol.

(D) average molar mass of final equilibrium mixture is approximately 75 g/mol.

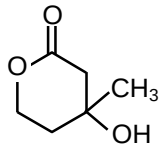
Space for Rough Work

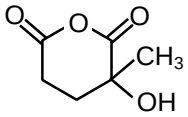
53. (P) + (Q) $\xrightarrow[\Delta]{H^{\oplus}}$  $\xrightarrow[\Delta]{H_3O^{\oplus}}$ (R)

find correct statement(s) about above reaction sequence.

(A) P & Q must be CH_3COOH and $HO–CH_2–CH_2–\underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}}–CH_2–COOH$

(B) P & Q must be CH_3CHO and $HO–CH_2–CH_2–\underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}}–CH_2–COOH$

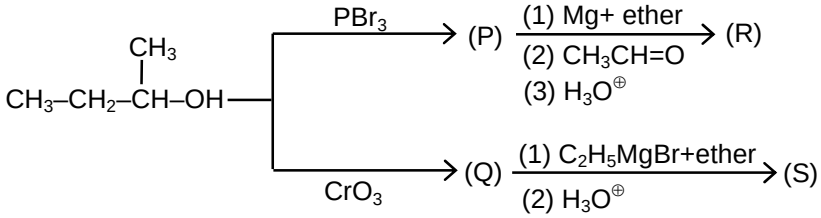
(C) R must be 

(D) R must be 

Space for Rough Work

CHEMISTRY

54.



Which amongs the following are correct for (R) and (S)?

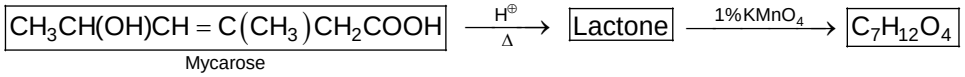
(A) Both R and S are positional isomers.

(B) Oxidised product of both R and S are same.

(C) Both R and S gives yellow precipitate of CHI_3 with NaOI.

(D) Both R and S can be distinguished by anhydrous $ZnCl_2$ in the presence of conc. HCl.

55. Mycarose occurs in several antibiotices. Using following reactions, find correct statements ?



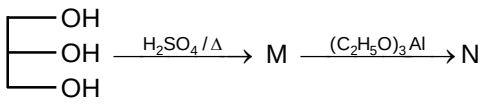
(A) Mycarose have E configuration across double bond.

(B) Mycarose have Z configuration at double bond.

(C) Total two hydroxyl groups are present in $C_7H_{12}O_4$

(D) Total four hydroxyl groups are present when $C_7H_{12}O_4$ is reduced with $LiAlH_4$

56. Observe the following reaction



Choose the correct option(s) :

(A) M is $CH_2=CH-CH=O$

(B) Conversion of M to N is a nucleophilic addition reaction.

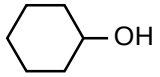
(C) N is $CH_2=CH-\underset{\underset{O}{\|}}{C}-O-CH_2-CH=CH_2$

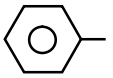
(D) M is $CH_2=CH-\underset{\underset{OH}{|}}{CH_2}$

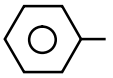
Space for Rough Work

57. Find the reaction product which gives precipitate with p-methylbenzene sulphonyl chloride & precipitate will be soluble in base.

(A) $R–OH \xrightarrow[(3)\,H_2+Ni]{(1)\,SOCl_2 \\ (2)\,KCN}$

(B)  $\xrightarrow[(3)\,H_2+Ni]{(1)\,H_2CrO_4 \\ (2)\,NH_3+\Delta}$

(C)  $\xrightarrow[(2)\,LiAlH_4]{(1)\,CH_3–\overset{\overset{O}{\|}}{C}–Cl}$

(D)  $\xrightarrow[(3)\,LiAlH_4 \\ (4)\,CH_3COCl \\ (5)\,LiAlH_4]{(1)\,NaNO_2+HCl+0^oC \\ (2)\,CuCN}$

58. Which amongs the following will give Cinnamic acid ?

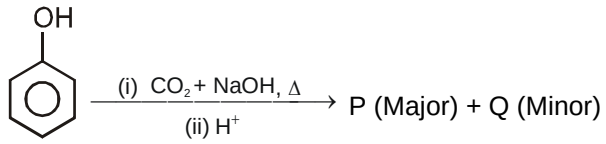
(A) $Ph–CHO \xrightarrow[(2)\,H_3O^{\oplus} \\ (3)\,\Delta]{(1)\,Ac_2O/AcONa,\ heat}$

(B) $Ph–CHO \xrightarrow[(2)\,H_3O^{\oplus} \\ (3)\,\Delta]{(1)\,CH_2(COOC_2H_5)_2,\ Pyridine,\ heat}$

(C) $Ph–CHO \xrightarrow[(2)\,H_3O^{\oplus} \\ (3)\,\Delta]{BrCH_2COOEt+Zn+\Delta}$

(D) $Ph–CHO \xrightarrow[(2)\,H_3O^{\oplus}]{(1)\,HCN}$

Space for Rough Work

59. 

Select the correct option(s) :

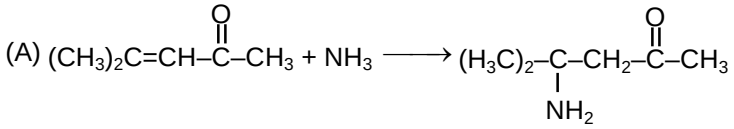
(A) Boiling point, (Q > P)

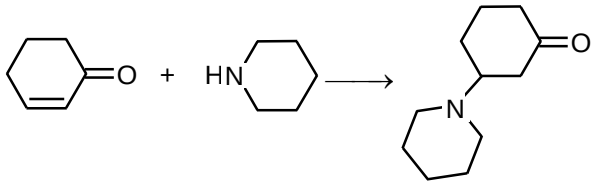
(B) Melting point, (Q > P)

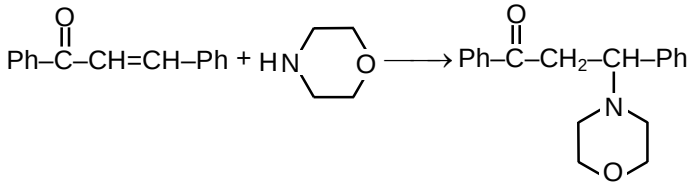
(C) Water solubility, (Q > P)

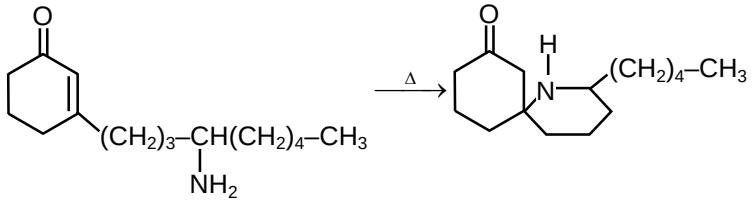
(D) Acidic Strength, (P > Q)

60. Which amongs the following reaction major product is correct.

(A) 

(B) 

(C) 

(D) 

Space for Rough Work