MOTION

JEE MAIN 2026

SAMPLE PAPER - 1

WITH SOLUTIONS

मोशन है , तो भरोसा है

MOTION

Sample Paper 1

Duration: 3 Hours **Max Marks: 300**

INSTRUCTIONS

In each part of the paper contains **25** questions. Please ensure that the Question paper you have received contains ALL THE QUESTIONS in each Part.

In each Part of The paper **Section A** Contain **20 Questions**. Each Question has four choices (A), (B), (C), (D) out of which **only one is correct** & carry **4 marks** each. **1 mark** will be deducted for each wrong answer.

In each Part of The paper **Section B** Contains **5 Numeric Answer type questions.** For each question, enter the correct numerical value ((If the numerical value has more than two decimal places, truncate/ round-off the value to TWO decimal places; e.g. 6.25, 7.00, 0.33, 30.27, 127.30.)

Each Question Carry **4 Marks** & **1 mark** will be deducted for each wrong answer.

NOTE : GENERAL INSTRUCTIONS FOR FILLING THE OMR ARE GIVEN BELOW.

1. Use only **blue/black pen (avoid gel pen)** for darkening the bubble.
2. Indicate the correct answer for each question by filling appropriate bubble in your OMR answer sheet.
3. The Answer sheet will be checked through computer hence, the answer of the question must be marked by shading the circles against the question by dark **blue/black pen**.
4. Blank papers, Clipboards, Log tables, Slide Rule, Calculators, Cellular Phones, Pagers and Electronic Gadgets in any form are **not** allowed to be carried inside the examination hall.

MOTION EDUCATION, 394 - Rajeev Gandhi Nagar, Kota-5 (Raj.)
✆ : 1800-212-1799| url : www.motion.ac.in | ✉ : info@motion.ac.in

INSTRUCTIONS FOR NUMERIC ANSWER FILLING IN OMR SHEET

1. Each answer contains four columns in numerical questions. (⓪⓪⓪⓪)

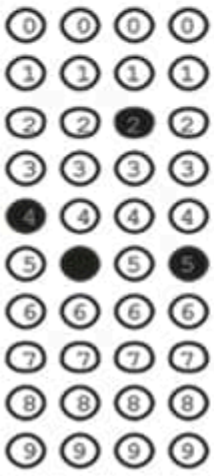
2. It is mandatory to fill all four columns while attending any of numerical questions, otherwise it will not be considered. (●●●●)

3. In numerical questions first two columns are reserved for 'Integers' and last two columns or 'Decimal' (⓪⓪ • ⓪⓪)

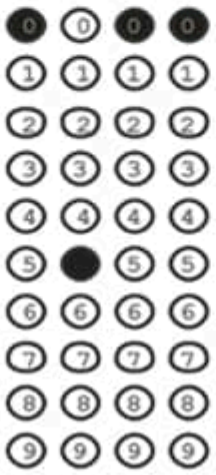
4. Don't use pen or pencil to mark decimal point. (⓪⓪•⓪⓪)

5. For your further guidance please go through the below mentioned examples:

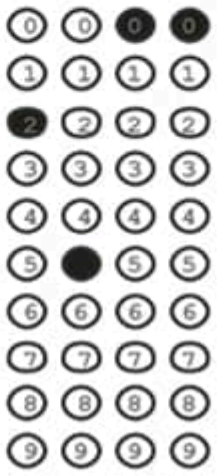
{a} Suppose your answer is - 45.25
Then mention it like



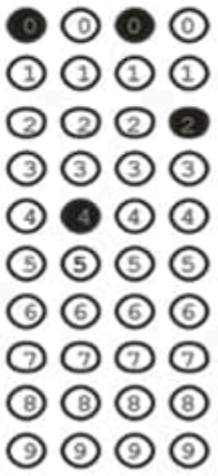
{b} Suppose your answer is - 5
Then mention it like



{c} Suppose your answer is – 25
Then mention it like



{d} Suppose your answer is – 4.02
Then mention it like



MATHS

SECTION - A

[SINGLE CORRECT TYPE]

Q.1 to ***Q.20*** has four choices (A), (B), (C), (D) out of which ***ONLY ONE*** is correct.

1. An ellipse has OB as semi minor axis, F and F′ its focii and the angle FBF′ is a right angle. Then the eccentricity of the ellipse is

(A) $\frac{1}{\sqrt{2}}$

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

(C) $\frac{1}{4}$

(D) $\frac{1}{\sqrt{3}}$

2. If c > 0, then the minimum distance of the point (0, c) from parabola $y = x^2$ is-

(A) $\sqrt{c-4}$

(B) $\sqrt{c-1/4}$

(C) $\sqrt{c+1/4}$

(D) None of these

3. If $x^2 + 3x + 5 = 0$ and $ax^2 + bx + c = 0$ have a common root and $a, b, c \in N$ then minimum value of $(a + b + c)$ is equal to

(A) 3

(B) 9

(C) 6

(D) 12

4. If $\lim_{n\to\infty}\left(\sqrt{n^2-n-1}+n\alpha+\beta\right)=0$, then $8(\alpha+\beta)$ is equal to :

(A) 4

(B) -8

(C) -4

(D) 8

5. A ray of light passing through the point A (1, 2) is reflected at a point B on the x-axis and then passes through (5, 3). Then the equation of AB is

(A) 5x + 4y = 13

(B) 5x – 4y = – 3

(C) 4x + 5y = 14

(D) 4x – 5y = – 6

1. एक दीर्घवृत्त की अर्ध लघु-अक्ष OB है, f व f' इसकी नाभियां है तथा कोण FBF' एक समकोण है। तब दीर्घवृत्त की उत्केन्द्रता है

(A) $\frac{1}{\sqrt{2}}$

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

(C) $\frac{1}{4}$

(D) $\frac{1}{\sqrt{3}}$

2. यदि c > 0, तो परवलय $y = x^2$ से बिंदु (0,c) की न्यूनतम दूरी है -

(A) $\sqrt{c-4}$

(B) $\sqrt{c-1/4}$

(C) $\sqrt{c+1/4}$

(D) इनमे से कोई नहीं

3. यदि $x^2 + 3x + 5 = 0$ तथा $ax^2 + bx + c = 0$ एक उभयनिष्ट मूल रखती है तथा $a, b, c \in N$ है, तब $(a + b + c)$ का न्यूनतम मान बराबर है -

(A) 3

(B) 9

(C) 6

(D) 12

4. यदि $\lim_{n\to\infty}\left(\sqrt{n^2-n-1}+n\alpha+\beta\right)=0$ है, तो $8(\alpha+\beta)$ बराबर है :

(A) 4

(B) -8

(C) -4

(D) 8

5. एक प्रकाश की किरण जो बिंदु A (1 ,2)से गुजरती है, x -अक्ष पर स्थित एक बिंदु B से परावर्तित होती है तथा तब (5 ,3)से गुजरती है | तब AB का समीकरण है -

(A) 5x + 4y = 13

(B) 5x – 4y = – 3

(C) 4x + 5y = 14

(D) 4x – 5y = – 6

6. Let the solution curve of the differential equation $x\frac{dy}{dx} - y = \sqrt{y^2 + 16x^2}$, $y(1) = 3$ be $y = y(x)$. Then y(2) is equal to:

(A) 15

(B) 11

(C) 13

(D) 17

7. The area bounded by the curves y = |x –1| + |x – 2| and y = 3 is equal to :

(A) 5

(B) 4

(C) 6

(D) 3

8. If $x \in (0, 2)$ then the value of $\int_0^1 e^{2x-[2x]}\, d(x-[x])$ is (where [*] denotes the greatest integer function)

(A) e + 1

(B) e

(C) 2e – 2

(D) $e - 1$

9. The relation $R = \{(a, b) : \gcd(a, b) = 1, 2a \neq b, a, b \in \mathbb{Z}\}$ is:

(A) reflexive but not symmetric

(B) transitive but not reflexive

(C) symmetric but not transitive

(D) neither symmetric nor transitive

10. The equation of a circle passing through the origin and cutting of intercepts each equal to 5 of the axes is -

(A) $x^2 + y^2 + 5x - 5y = 0$

(B) $x^2 + y^2 - 5x + 5y = 0$

(C) $x^2 + y^2 - 5x - 5y = 0$

(D) $x^2 + y^2 + 5x + 5y = 0$

11. Let z_1 and z_2 be two complex numbers such that $\overline{z}_1 = i\,\overline{z}_2$ and $\arg\left(\frac{z_1}{\overline{z}_2}\right) = \pi$, then

(A) $\arg\ z_2 = \frac{\pi}{4}$

(B) $\arg\ z_2 = \frac{-3\pi}{4}$

(C) $\arg\ z_1 = \frac{\pi}{4}$

(D) $\arg\ z_1 = \frac{-3\pi}{4}$

6. माना अवकल समीकरण $x\frac{dy}{dx} - y = \sqrt{y^2 + 16x^2}$, $y(1) = 3$ का हल वक्र $y = y(x)$ है। तब $y(2)$ का मान है :

(A) 15

(B) 11

(C) 13

(D) 17

7. वक्रों y = |x –1| + |x – 2| तथा y = 3 से परिबद्ध क्षेत्र का क्षेत्रफल है:

(A) 5

(B) 4

(C) 6

(D) 3

8. यदि $x \in (0, 2)$ तब $\int_0^1 e^{2x-[2x]}\, d(x-[x])$ का मान बराबर है (जहाँ [*] महत्तम पूर्णांक फलन है)

(A) e + 1

(B) e

(C) 2e – 2

(D) $e - 1$

9. संबंध
$R = \{(a, b) : \gcd(a, b) = 1, 2a \neq b, a, b \in \mathbb{Z}\}$

(A) स्वतुल्य है परन्तु सममित नहीं है

(B) संक्रामक है परन्तु स्वतुल्य नहीं है

(C) सममित है परन्तु संक्रामक नहीं है

(D) न तो सममित है न ही संक्रामक है

10. मूल बिन्दु से गुजरने वाले तथा प्रत्येक अक्ष पर +5 के बराबर अंतखण्डों को काटने वाले एक वृत्त का समीकरण होगा -

(A) $x^2 + y^2 + 5x - 5y = 0$

(B) $x^2 + y^2 - 5x + 5y = 0$

(C) $x^2 + y^2 - 5x - 5y = 0$

(D) $x^2 + y^2 + 5x + 5y = 0$

11. माना दो सम्मिश्र संख्याओं z_1 तथा z_2 के लिए $\overline{z}_1 = i\,\overline{z}_2$ तथा $\arg\left(\frac{z_1}{\overline{z}_2}\right) = \pi$ हैं। तो

(A) $\arg\ z_2 = \frac{\pi}{4}$

(B) $\arg\ z_2 = \frac{-3\pi}{4}$

(C) $\arg\ z_1 = \frac{\pi}{4}$

(D) $\arg\ z_1 = \frac{-3\pi}{4}$

12. Find three numbers in G.P. such that their sum is 14 and the sum of their squares is 84 -

(A) $3, 6, 12$

(B) $2, 6, 18$

(C) $1, 3, 9$

(D) $2, 4, 8$

13. If $6^{83} + 8^{83}$ is divided by 49 , then the remainder is

(A) 35

(B) 5

(C) 1

(D) 0

14. Consider a tetrahedron with faces f_1, f_2, f_3, f_4 Let $\vec{a}_1$, $\vec{a}_2$, $\vec{a}_3$, $\vec{a}_4$ be the vectors whose magnitudes are respectively equal to the areas of f_1, f_2, f_3, f_4 and whose directions are perpendicular to these faces in the outward direction. Then

(A) $\vec{a}_1 + \vec{a}_2 + \vec{a}_3 + \vec{a}_4 = 0$

(B) $\vec{a}_1 + \vec{a}_3 = \vec{a}_2 + \vec{a}_4$

(C) $\vec{a}_1 + \vec{a}_2 = \vec{a}_3 + \vec{a}_4$

(D) $\vec{a}_1 - \vec{a}_2 - \vec{a}_3 - \vec{a}_4 = 0$

15. If A and B are non-singular square matrix of same order 3×3, then which of the following options is correct?

(A) $|\text{adj}(AB)| = |A||B|$

(B) $\left|(\text{adj } AB)^{-1}\right| = \left|\text{adj}(AB)\right|$

(C) $\left|\text{adj } (AB)^{-1}\right| = \left|(\text{adj } AB)^{-1}\right|$

(D) $\left|\text{adj } (AB)^{T}\right| = \left|AB\right|^{-2}$

16. The domain set of the function $f(x) = \tan^{-1} x - \cot^{-1} x + \cos^{-1}(2 - x)$ is

(A) $[0, 1]$

(B) $[-1, 1]$

(C) $[1, 3]$

(D) None of these

17. Let A and B are two matrices of order 3×3, where $|A| = -2$ and $|B| = 2$, then $\left|A^{-1}\,\text{adj}(B^{-1})\,\text{adj}\left(2\,A^{-1}\right)\right|$ is equal to

(A) 2

(B) -2

(C) 4

(D) 8

12. गुणोत्तर श्रेणी में तीन संख्याओं को ज्ञात कीजिए ताकि उनका योगफल 14 है तथा उनके वर्गों का योगफल 84 हो-

(A) $3, 6, 12$

(B) $2, 6, 18$

(C) $1, 3, 9$

(D) $2, 4, 8$

13. यदि $6^{83} + 8^{83}$ को 49 से विभाजित किया जाता है, तब शेषफल है

(A) 35

(B) 5

(C) 1

(D) 0

14. माना एक चतुष्फलक के पृष्ठ f_1, f_2, f_3, f_4 है। माना $\vec{a}_1$, $\vec{a}_2$, $\vec{a}_3$, $\vec{a}_4$ सदिश हैं जिनके परिमाण क्रमशः f_1, f_2, f_3, f_4 के क्षेत्रफलों के बराबर हैं और दिशा इन पृष्ठों के लम्बवत् बाहर की ओर है, तो -

(A) $\vec{a}_1 + \vec{a}_2 + \vec{a}_3 + \vec{a}_4 = 0$

(B) $\vec{a}_1 + \vec{a}_3 = \vec{a}_2 + \vec{a}_4$

(C) $\vec{a}_1 + \vec{a}_2 = \vec{a}_3 + \vec{a}_4$

(D) $\vec{a}_1 - \vec{a}_2 - \vec{a}_3 - \vec{a}_4 = 0$

15. यदि समान क्रम 3×3 की व्युत्क्रमणीय वर्ग आव्यूह A तथा B हैं, तब निम्न विकल्पों में से कौनसा सही है?

(A) $|\text{adj}(AB)| = |A||B|$

(B) $\left|(\text{adj } AB)^{-1}\right| = \left|\text{adj}(AB)\right|$

(C) $\left|\text{adj}(AB)^{-1}\right| = \left|(\text{adj } AB)^{-1}\right|$

(D) $\left|\text{adj}(AB)^{T}\right| = \left|AB\right|^{-2}$

16. फलन $f(x) = \tan^{-1} x - \cot^{-1} x + \cos^{-1}(2 - x)$ का प्रांत समुच्चय है

(A) $[0, 1]$

(B) $[-1, 1]$

(C) $[1, 3]$

(D) इनमें से कोई नहीं

17. माना 3×3 क्रम की दो आव्यूह A व B हैं जहां $|A| = -2$ तथा $|B| = 2$ हैं, तब $\left|A^{-1}\,\text{adj}(B^{-1})\,\text{adj}\left(2\,A^{-1}\right)\right|$ बराबर है-

(A) 2

(B) -2

(C) 4

(D) 8

18. The period of the function $f(x) = [6x + 7] + \cos\pi x - 6x$, where $[.]$ denotes the greatest integer function, is

(A) 3

(B) 2π

(C) 2

(D) None of these

19. $\frac{d^2x}{dy^2}$ equals :

(A) $\left(\frac{d^2y}{dx^2}\right)^{-1}$

(B) $-\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right)^{-3}$

(C) $\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right)^{2}$

(D) $-\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right)^{-1}$

20. The expression $\frac{\cos\ 6x+6\cos\ 4x+15\cos\ 2x+10}{\cos\ 5x+5\cos\ 3x+10\cos x}$ is equal to

(A) cos 2x

(B) 2 cos x

(C) $\cos^2$ x

(D) 1 + cos x

18. फलन $f(x) = [6x + 7] + \cos\pi x - 6x$ का आवर्तकाल होगा, जहाँ [.] महत्तम पूर्णांक फलन को दर्शाता है-

(A) 3

(B) 2π

(C) 2

(D) इनमे से कोई नहीं

19. $\frac{d^2x}{dy^2}$ बराबर है

(A) $\left(\frac{d^2y}{dx^2}\right)^{-1}$

(B) $-\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right)^{-3}$

(C) $\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right)^{2}$

(D) $-\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right)^{-1}$

20. व्यंजक $\frac{\cos\ 6x+6\cos\ 4x+15\cos\ 2x+10}{\cos\ 5x+5\cos\ 3x+10\cos x}$ का मान है

(A) cos 2x

(B) 2 cos x

(C) $\cos^2$ x

(D) 1 + cos x

SECTION - B

[NUMERIC VALUE TYPE]

Q.21 to ***Q.25*** are ***NUMERIC VALUE TYPE*** Questions. The answer to each question is a **NUMERICAL VALUE.**

21. Let a plane P pass through the point (3,7,-7) and contain the line, $\frac{x-2}{-3} = \frac{y-3}{2} = \frac{z+2}{1}$. If distance of the plane P from the origin is d, then d^2 is equal to _____.

21. मान लीजिए कि एक समतल P बिंदु (3,7,-7) से होकर गुजरता है और इसमें रेखा $\frac{x-2}{-3} = \frac{y-3}{2} = \frac{z+2}{1}$ उपस्थित है। यदि मूल बिंदु से समतल P की दूरी d है, तो d^2 बराबर है।

22. Six boys and six girls sit along a line alternately in x ways and along a circle (again alternately) in y ways, then x/y equals to:

22. छः लड़के तथा छः लड़कियाँ एकान्तर(alternately) रूप से एक रेखा के अनुदिश x तरिको से बैठ सकते है तथा एक वृत्त (पुनः एकान्तर रूप से) के अनुदिश y तरिको से बैठ सकते है तब x/y बराबर है :

23. Function f(x) = (|x − 1| + |x − 2| + cos x) where x ∈ [0, 4] is not continuous at number of points

23. फलन f(x) = (|x − 1| + |x − 2| + cos x), जहाँ x ∈ [0, 4] है, के बिन्दुओं की संख्या जहां यह सतत् नही है, होगी

24. If A and B are two events such that $P(A) = \frac{4}{7}$, $P(A \cap B) = \frac{3}{28}$ and the conditional probability $P\left(\frac{A}{(A^c \cup B^c)}\right)$ (where A^c denotes the compliment of the event A) is equal to λ, then the value of $\frac{26}{\lambda}$ is equal to

24. यदि A तथा B दो घटनाऐ इस प्रकार है कि $P(A) = \frac{4}{7}, P(A \cap B) = \frac{3}{28}$ है तथा प्रतिबंधित प्रायिकता $P\left(\frac{A}{(A^c \cup B^c)}\right)$ (जहाँ A^c घटना A के पूरक (compliment) को दर्शाती है) λ के बराबर है, तब $\frac{26}{\lambda}$ का मान बराबर है -

25. If the largest possible interval in which f(x) = x^3+6x^2+px+7 is decreasing function is (−3,−1) then p equals

25. यदि (-3 ,-1) वह महत्तम संभव अंतराल है जिसमें $f(x) = x^3+6x^2+px+7$ एक ह्यसमान फलन है तब p बराबर है

PHYSICS

SECTION - A

[SINGLE CORRECT TYPE]

Q.1 to ***Q.20*** has four choices (A), (B), (C), (D) out of which ***ONLY ONE*** is correct.

1. An aeroplane is flying at a height of 1960 m is horizontal direction with a velocity of 360 km/hr. When it is vertically above the point A on the ground, it drops a bomb, find out distance from A it travelled on the aground.

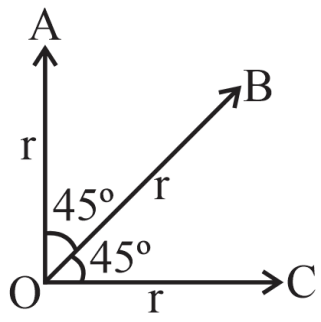
(A) 1 km

(B) 2 km

(C) 3 km

(D) 4 km

2. Find the resultant of three vectors $\overrightarrow{OA}$, $\overrightarrow{OB}$ and $\overrightarrow{OC}$ each of magnitude r as shown in figure ?



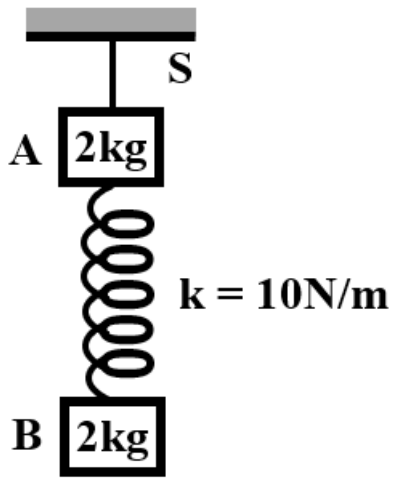
(A) $r\left(1-\sqrt{2}\right)$

(B) $2r\left(1+\sqrt{2}\right)$

(C) $r\left(1+\sqrt{2}\right)$

(D) $2r\left(1-\sqrt{2}\right)$

3. The system shown in figure is in equilibrium. The spring is light, the acceleration of both the blocks (in m/s^2) just after the string S is cut is -



(A) $a_A = 10, a_B = 0$

(B) $a_A = 0, a_B = 10$

(C) $a_A = 20, a_B = 0$

(D) $a_A = 0, a_B = 20$

1. एक हवाई जहाज 1960 m की ऊँचाई पर क्षैतिज दिशा में 360 km/hr के वेग से उड़ रहा है। जब यह जमीन पर स्थित बिंदु A के ऊर्ध्वाधर रूप से ऊपर होता है,तब यह एक बम गिराता है, A से वह दूरी ज्ञात कीजिए जहां यह जमीन से टकराता है?

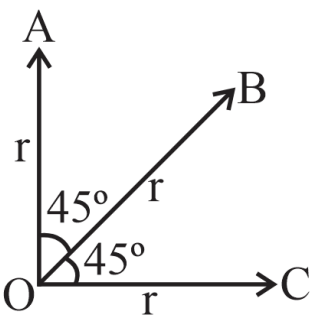
(A) 1 km

(B) 2 km

(C) 3 km

(D) 4 km

2. $\overrightarrow{OA}$, $\overrightarrow{OB}$ व $\overrightarrow{OC}$ तीन सदिशों का परिणामी ज्ञात करो, चित्रानुसार प्रत्येक का परिमाण r है ?



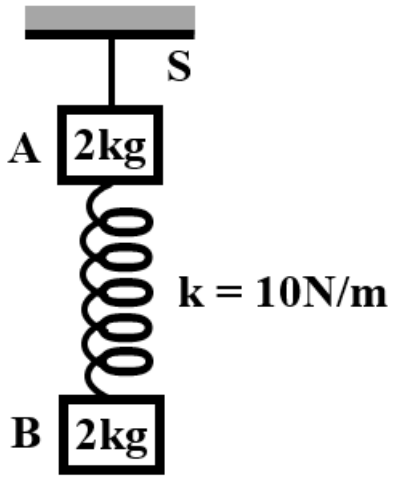
(A) $r\left(1-\sqrt{2}\right)$

(B) $2r\left(1+\sqrt{2}\right)$

(C) $r\left(1+\sqrt{2}\right)$

(D) $2r\left(1-\sqrt{2}\right)$

3. चित्र में दर्शाया गया निकाय साम्यवस्था में है। स्प्रिंग हल्की है, डोरी S के काटने के तुरन्त पश्चात दोनो ब्लॉको का त्वरण (m/s^2 में) है -



(A) $a_A = 10, a_B = 0$

(B) $a_A = 0, a_B = 10$

(C) $a_A = 20, a_B = 0$

(D) $a_A = 0, a_B = 20$

4. A particle is performing circular motion of radius 1m. Its speed is v = $(2t^2)$ m/s. Its acceleration at t = 1s is :-

(A) 4 m/s^2

(B) $4\sqrt{2}$ m/s^2

(C) $4\sqrt{17}$ m/s^2

(D) $4\sqrt{3}$ m/s^2

5. The displacement x and time t for a particle are related to each other as t = $\sqrt{x}$ + 3. What is work done in first six seconds of its motion :-

(A) 6 J

(B) zero

(C) 4 J

(D) 2 J

6. A metal ball falls from a height of 32 metre on a steel plate. If the coefficient of restitution is 0.5, to what height will the ball rise after second bounce

(A) 2 m

(B) 4 m

(C) 8 m

(D) 16 m

7. A car battery with a 12V emf and an internal resistance of 0.04Ω is being charged with a current of 50A. The potential difference V across the terminals of the battery are :

(A) 10 V

(B) 12 V

(C) 14V

(D) 16V

4. एक कण 1m त्रिज्या के पथ पर वृत्तीय गति करता है। इसकी चाल V = $(2t^2)$ m/s है। t = 1s पर इसका त्वरण होगाः-

(A) 4 m/s^2

(B) $4\sqrt{2}$ m/s^2

(C) $4\sqrt{17}$ m/s^2

(D) $4\sqrt{3}$ m/s^2

5. किसी कण के लिए विस्थापन x और समय t एक दूसरे से t = $\sqrt{x}$ + 3 के रूप में सम्बन्धित है | गति के प्रथम 6 सेकंडो में किया गया कार्य होगा :-

(A) 6 J

(B) शून्य

(C) 4 J

(D) 2 J

6. एक धातु की गेंद, एक स्टील प्लेट पर 32 मीटर की ऊँचाई से गिरती है। यदि प्रत्यावस्थान गुणांक 0.5 है, तब दूसरे उछाल के पश्चात गेंद किस ऊँचाई तक उठेगी -

(A) 2 m

(B) 4 m

(C) 8 m

(D) 16 m

7. किसी कार की बैटरी जिसका वि.वा.बल 12V तथा आन्तरिक प्रतिरोध 0.04Ω है, को 50A की धारा के साथ आवेशित किया जाता है। बैटरी के सिरों पर विभवान्तर V होगा -

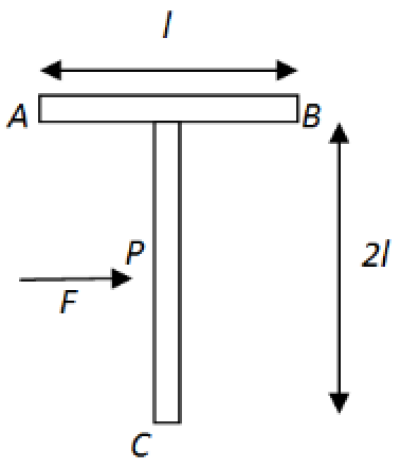
(A) 10 V

(B) 12 V

(C) 14V

(D) 16V

8. A T shaped uniform density object with dimensions shown in the figure is lying on a smooth floor. A force F is applied at the point P parallel to AB such that the object has only the translational motion without rotation. Find the location of P with respect to C.



(A) $\frac{4}{3}$l

(B) l

(C) $\frac{3}{4}$l

(D) $\frac{3}{2}$l

9. A pulley is rotated about its axis by a force $F = (20t - 5t^2)N$ (where t is in seconds) applied tangentially. Find the magnitude of angular impulse [in Nm-s] on the pulley in the initial 2s. Given radius of pulley 0.5m

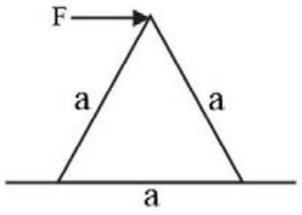
(A) $\frac{80}{3}$

(B) $\frac{40}{3}$

(C) $\frac{20}{3}$

(D) $\frac{10}{3}$

10. An equilateral prism of mass m rests on a rough horizontal surface, with a coefficient of friction μ. A horizontal force F is applied to the prism, as shown in the figure. If the coefficient of friction is sufficiently high, so that the prism does not slide before toppling, then the minimum value of force F required to topple the prism is



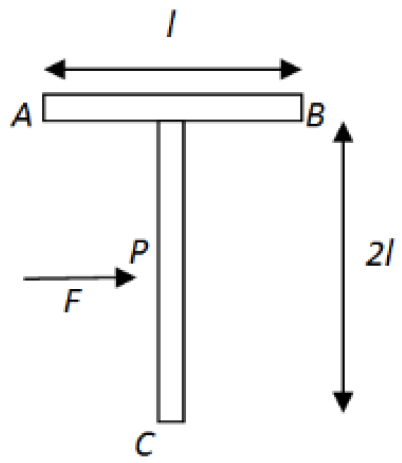
(A) $\frac{mg}{\sqrt{3}}$

(B) $\frac{mg}{4}$

(C) $\frac{\mu mg}{\sqrt{3}}$

(D) $\frac{\mu mg}{4}$

8. चित्रानुसार आयामों (dimensions) वाली एक T- आकार की एक समान घनत्व की वस्तु एक चिकने फर्श पर स्थित है। AB के समानान्तर बिन्दु P पर एक बल F इस प्रकार लगाया जाता है कि वस्तु में बिना घूर्णन के केवल स्थानान्तरीय गति होती है। C के सापेक्ष P की स्थिति ज्ञात कीजिए।



(A) $\frac{4}{3}$l

(B) l

(C) $\frac{3}{4}$l

(D) $\frac{3}{2}$l

9. एक घिरनी स्पर्शरिखीय रूप से लगाए गए बल $F = (20t - 5t^2)N$ (जहां t सेकंड में है) द्वारा अपने अक्ष के परितः घूर्णन करती है। प्रारम्भिक 2s में घिरनी पर कोणीय आवेग का परिमाण [Nm-s में] ज्ञात करे। घिरनी की त्रिज्या 0.5m दी गई है।

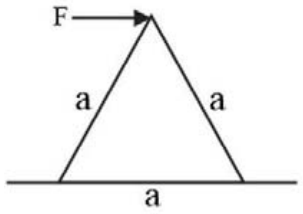
(A) $\frac{80}{3}$

(B) $\frac{40}{3}$

(C) $\frac{20}{3}$

(D) $\frac{10}{3}$

10. m द्रव्यमान का एक समबाहु प्रिज्म μ घर्षण गुणांक वाली एक खुरदरी क्षैतिज सतह पर विराम पर है। एक क्षैतिज बल F चित्रानुसार प्रिज्म पर आरोपित किया जाता है। यदि घर्षण गुणांक पर्याप्त रूप से अधिक है, ताकि प्रिज्म गिरने (toppling) से पहले फिसले नहीं, तब प्रिज्म को गिराने के लिए आवश्यक बल F का न्यूनतम मान है -



(A) $\frac{mg}{\sqrt{3}}$

(B) $\frac{mg}{4}$

(C) $\frac{\mu mg}{\sqrt{3}}$

(D) $\frac{\mu mg}{4}$

11. The time period of oscillations of a block attached to a spring is t_1. When the spring is replaced by another spring, the time period of the block is t_2. If both the springs are connected in series and the block is made to oscillate using the combination, then the time period of the block is

(A) $T = t_1 + t_2$

(B) $T^2 = t_1^2 + t_2^2$

(C) $T^{-1} = t_1^{-1} + t_2^{-1}$

(D) $T^{-2} = t_1^{-2} + t_2^{-2}$

12. The formula for time period of a compound pendulum is:

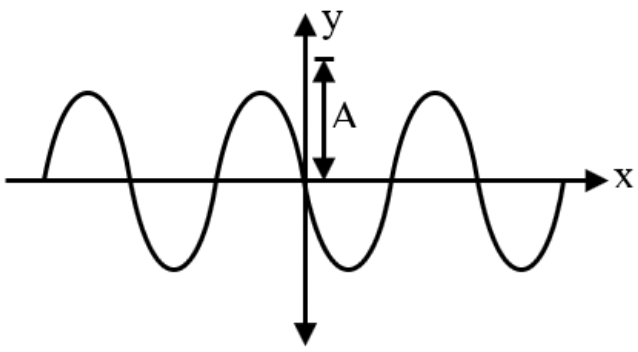
(A) $T = 2\pi\sqrt{\frac{I}{g}}$

(B) $T = 2\pi\sqrt{\frac{I}{mg\ell}}$

(C) $T = 2\pi\sqrt{\frac{m}{k}}$

(D) $T = 2\pi\sqrt{\frac{k}{m}}$

13. A progressive wave travelling along the positive x-direction is represented by y(x,t) = A sin(kx − ωt + φ). Its snapshot at t = 0 is given in the figure.



For this wave, the phase φ is :

(A) $\frac{\pi}{2}$

(B) 0

(C) π

(D) $-\frac{\pi}{2}$

14. One kg of water, at 20°C, is heated in an electric kettle whose heating element has a mean (temperature averaged) resistance of 20Ω. The rms voltage in the mains is 200 V. Ignoring heat loss from the kettle, time taken for water to evaporate fully, is close to :

[Specific heat of water = 4200 J/(kg °C), Latent heat of water = 2260 kJ/kg]

(A) 10 minutes

(B) 16 minutes

(C) 3 minutes

(D) 22 minutes

11. एक स्प्रिंग से जुड़े एक ब्लॉक के दोलन का आवर्तकाल t_1 है। जब स्प्रिंग अन्य स्प्रिंग से बदली जाती है, तब ब्लॉक का आवर्तकाल t_2 है। यदि दोनों स्प्रिंगे श्रेणी में जोड़ी जाती है तथा ब्लॉक को संयोजन का प्रयोग करते हुए दोलन के लिए बनाया जाता है, तब ब्लॉक का आवर्तकाल है:-

(A) $T = t_1 + t_2$

(B) $T^2 = t_1^2 + t_2^2$

(C) $T^{-1} = t_1^{-1} + t_2^{-1}$

(D) $T^{-2} = t_1^{-2} + t_2^{-2}$

12. संयुक्त लोलक के आवर्तकाल का सूत्र है-

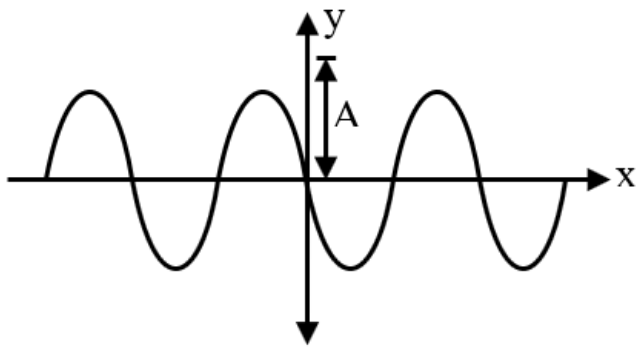
(A) $T = 2\pi\sqrt{\frac{I}{g}}$

(B) $T = 2\pi\sqrt{\frac{I}{mg\ell}}$

(C) $T = 2\pi\sqrt{\frac{m}{k}}$

(D) $T = 2\pi\sqrt{\frac{k}{m}}$

13. धनात्मक x दिशा में गमन करती हुई किसी प्रगामी तरंग को y(x,t) = A sin(kx − ωt + φ) से निरुपित किया जाता है। t = 0 पर खीचा गया फोटो/आशुचित्र चित्र में दिया गया है।



इस तरंग के लिए, कला φ का मान है -

(A) $\frac{\pi}{2}$

(B) 0

(C) π

(D) $-\frac{\pi}{2}$

14. एक किलो पानी को 20°C पर एक विद्युत केटली में गर्म किया जाता है, जिसके ऊष्मीय अवयव का औसत (औसत तापमान) प्रतिरोध 20Ω है। विद्युत प्रदाय का वर्ग माध्य मूल वोल्टता 200 V है। केटली से हुई ऊष्मा हानि को नजरअंदाज करते हुए, पानी को पूरी तरह से वाष्पित होने में लगने वाला समय, लगभग होगा:

[जल की विशिष्ट ऊष्मा = 4200 J/(kg °C), जल की गुप्त ऊष्मा = 2260 kJ/kg]

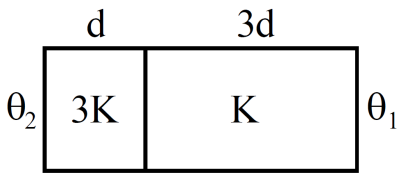
(A) 10 मिनट

(B) 16 मिनट

(C) 3 मिनट

(D) 22 मिनट

15. Two materials having coefficients of thermal conductivity '3K' and 'K' and thickness 'd' and '3d', respectively, are joined to form a slab as shown in the figure.The temperatures of the outer surfaces are 'θ_2' and 'θ_1' respectively, ($\theta_2 > \theta_1$). The temperature at the interface is :



(A) $\frac{\theta_1+\theta_2}{2}$

(B) $\frac{\theta_1}{10} + \frac{9\theta_2}{10}$

(C) $\frac{\theta_1}{3} + \frac{2\theta_2}{3}$

(D) $\frac{\theta_1}{6} + \frac{5\theta_2}{6}$

16. When the pressure on water is increased then boiling temperature of water as compared to 100°C will be :-

(A) lower

(B) the same

(C) higher

(D) on the critical temperature

17. Total internal reflection takes place -

(A) when a ray moves from denser to rarer medium and incident angle is greater than critical angle

(B) when a ray moves from rarer to denser medium and incident angle is less than critical angle

(C) when a ray moves from rarer to denser medium and incident angle is equal to critical angle

(D) None of the above

18. Which of the following are true?
A. Speed of light in vacuum is dependent on the direction of propagation.
B. Speed of light in a medium in independent of the wavelength of light.
C. The speed of light is independent of the motion of the source.
D. The speed of light in a medium is independent of intensity.
Choose the correct answer from the option given below :

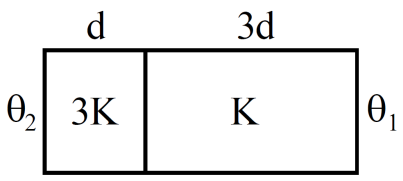
(A) A and C only

(B) B and D only

(C) B and C only

(D) C and D only

15. दिखाये गये चित्रानुसार '3K' तथा 'K' ऊष्मा चालकता गुणांक एवं क्रमशः 'd' तथा '3d' मोटाई वाले दो पदार्थों को जोडकर एक पट्टिका बनायी गयी है। बाहरी सतहों के तापमान क्रमशः 'θ_2' और 'θ_1' है ($\theta_2 > \theta_1$) । अंतरापृष्ठ पर तापमान है:



(A) $\frac{\theta_1+\theta_2}{2}$

(B) $\frac{\theta_1}{10} + \frac{9\theta_2}{10}$

(C) $\frac{\theta_1}{3} + \frac{2\theta_2}{3}$

(D) $\frac{\theta_1}{6} + \frac{5\theta_2}{6}$

16. जब पानी पर दाब बढ़ाया जाता है, तो 100°C की तुलना में पानी का क्वथनांक होगा :-

(A) कम

(B) समान

(C) उच्च

(D) क्रान्तिक ताप पर

17. पूर्ण आन्तरिक परावर्तन घटित होता है -

(A) जब एक किरण सघन से विरल माध्यम में गति करती है तथा आपतन कोण, क्रांतिक कोण से अधिक होता है।

(B) जब एक किरण विरल से सघन माध्यम में गति करती है तथा आपतन कोण, क्रांतिक कोण से कम होता है।

(C) जब एक किरण विरल से सघन माध्यम में गति करती है तथा आपतन कोण, क्रांतिक कोण के बराबर होता है।

(D) इनमें से कोई नहीं

18. निम्नलिखित में से कौनसा सही है ?
A. निर्वात में प्रकाश की चाल संचरण की दिशा पर निर्भर करती है।
B. माध्यम में प्रकाश की चाल प्रकाश की तरंग दैर्ध्य पर निर्भर नहीं करती है।
C. प्रकाश की चाल स्रोत की गति पर निर्भर नहीं करती है।
D. माध्यम में प्रकाश की चाल तीव्रता पर निर्भर नहीं करती है।
नीचे दिये गये विकल्पों में से सही उत्तर चुनिएँ :

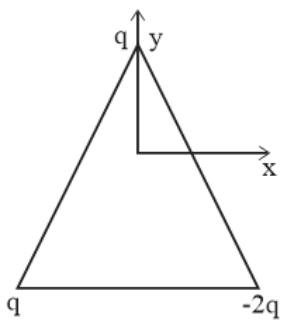
(A) A और C केवल

(B) B और D केवल

(C) B और C केवल

(D) C और D केवल

19. An equilateral triangle wire frame of side L having 3 point charges at its vertices is kept in $x-y$ plane as shown. Component of electric field due to the configuration in z direction at $(0,0,L)$ is [origin is centroid of triangle].



(A) $\frac{9\sqrt{3}k\,q}{8\,L^2}$

(B) zero

(C) $\frac{9k\,q}{8\,L^2}$

(D) none

20. Consider a planet in some solar system which has a mass double the mass of earth and density equal to the average density of earth. If the weight of an object on earth is W, then weight of the same object on that planet will be -

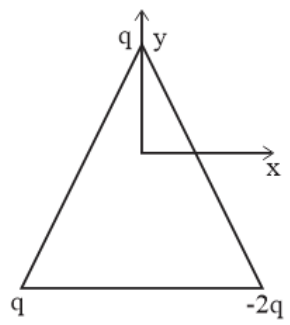
(A) $\sqrt{2}W$

(B) 2W

(C) W

(D) $2^{\frac{1}{3}}W$

19. भुजा L का एक समबाहु त्रिभुज तार फ्रेम जिसके शीर्ष पर 3 बिंदु आवेश हैं, को x-y तल में रखा गया है जैसा कि दिखाया गया है। $(0,0,L)$ पर z दिशा में विन्यास के कारण विद्युत क्षेत्र का घटक होगा [मूल बिन्दु त्रिभुज का केन्द्रक है]



(A) $\frac{9\sqrt{3}k\,q}{8\,L^2}$

(B) शून्य

(C) $\frac{9k\,q}{8\,L^2}$

(D) कोई नहीं

20. किसी सौर मंडल में एक ग्रह पर विचार करें जिसका द्रव्यमान पृथ्वी के द्रव्यमान से दोगुना है और घनत्व पृथ्वी के औसत घनत्व के बराबर है। यदि किसी वस्तु का पृथ्वी पर भार W है, तो उसी वस्तु का उस ग्रह पर भार होगा–

(A) $\sqrt{2}W$

(B) 2W

(C) W

(D) $2^{\frac{1}{3}}W$

PHYSICS

SECTION - B

[NUMERIC VALUE TYPE]

Q.21 to ***Q.25*** are ***NUMERIC VALUE TYPE*** Questions. The answer to each question is a **NUMERICAL VALUE.**

21. Four resistances of 15 Ω, 12 Ω, 4 Ω and 10 Ω respectively in cyclic order to form Wheatstone's network. The resistance that is to be connected in parallel with the resistance of 10 Ω to balance the network is ..... Ω.

21. 15 Ω, 12 Ω, 4 Ω तथा 10 Ω के क्रमशः चार प्रतिरोधों को चक्रीय क्रम में जोड़कर एक व्हीटस्टोन नेटवर्क बनाया जाता है। इस नेटवर्क को संतुलित करने के लिए 10 Ω के प्रतिरोध के साथ समानांतर में जोड़ा जाने वाला प्रतिरोध ..... Ω है।

22. A long solenoid with 1000 turns/m has a core material with relative permeability 500 and volume 10^3 cm^3. If the core material is replaced by another material having relative permeability of 750 with same volume maintaining same current of 0.75 A in the solenoid, the fractional change in the magnetic moment of the core would be approximately $\left(\frac{x}{499}\right)$. Find the value of $\frac{x}{10}$ and give answer in nearest integer.

22. 1000 फेरे प्रति मीटर की एक लम्बी परिनालिका में सापेक्षिक चुंबकशीलता 500 तथा आयतन 10^3 cm^3 का एक क्रोड पदार्थ रखा है। यदि क्रोड पदार्थ को 750 सापेक्षिक चुंबकशीलता तथा समान आयतन के दूसरे क्रोड पदार्थ से प्रतिस्थापित कर दिया जाए तो परिनालिका 0.75 A की समान धारा बनाए रखते हुए, क्रोड के चुम्बकीय आघूर्ण में भिन्नात्मक परिवर्तन लगभग $\left(\frac{x}{499}\right)$ होगा। $\frac{x}{10}$ का मान ज्ञात कीजिए तथा उत्तर निकटतम पूर्णांक में दीजिए ।

23. The radius of a nucleus of mass number 64 is 4.8 fermi. Then the mass number of another nucleus having radius of 4 fermi is $\frac{1000}{x}$, where x is _____.

23. द्रव्यमान संख्या 64 के नाभिक की त्रिज्या 4.8 फर्मी है। तब 4 फर्मी त्रिज्या वाले दूसरे नाभिक की द्रव्यमान संख्या $\frac{1000}{x}$ है, जहां x _____ है।

24. In the Coolidge tube experiment, if the applied voltage is increased to three times, the short wavelength limit of continuous X ray spectrum shifts by 20 pm. What is the initial voltage (in kV) applied to the tube?

[hc = 1240 eV.nm]

[round-off to nearest integer]

24. कूलिज नलिका प्रयोग में, यदि आरोपित वोल्टता को तीन गुना बढाया जाता है, तो सतत X-किरण स्पेक्ट्रम की लघु तरंगदैर्ध्य सीमा 20 pm तक स्थानांतरित होती है। नलिका पर आरोपित प्रारम्भिक वोल्टता (kV में) कितनी है?

[hc = 1240 eV.nm]

[निकटतम पूर्णांक तक पूर्णांकित करें]

25. A bullet of mass 10 g and speed $500\ m\ s^{-1}$ is fired into a door and gets embedded exactly at the centre of the door. The door is 1.0 m wide and weighs 12 kg. It is hinged at one end and rotates about a vertical axis practically without friction. If ω is the angular speed (in rad s^{-1}) of the door just after the bullet embeds into it, then find the value of 10ω. Ignore the mass of the bullet as compared to the door.

25. 10 g द्रव्यमान और $500\ m\ s^{-1}$ चाल की एक गोली एक दरवाजे में दागी जाती है और दरवाजे के बिल्कुल केंद्र में अंत:स्थापित हो जाती है। दरवाजा 1.0 m चौड़ा है और इसका भार 12 kg है। यह एक सिरे पर किलकित है और प्रायोगिक रूप से बिना किसी घर्षण के ऊर्ध्वाधर अक्ष के परितः घूर्णन करता है। यदि गोली दरवाजे में घुसने के ठीक बाद दरवाजे की कोणीय चाल (rad s^{-1} में) ω है, तो 10 ω का मान ज्ञात कीजिए। दरवाजे की तुलना में गोली के द्रव्यमान को नगण्य माने।

CHEMISTRY

SECTION - A

[SINGLE CORRECT TYPE]

Q.1 to ***Q.20*** has four choices (A), (B), (C), (D) out of which ***ONLY ONE*** is correct.

1. Which of the following will have the lowest fourth ionization enthalpy IE_4?

(A) La^{4+}

(B) Gd^{4+}

(C) Lu^{4+}

(D) Sm^{+3}

2. Match List-I with List-II:

List - I Test/Reagents/ Observation(s)		**List-II Species detected**	
(a)	Lassaigne's Test	(i)	Carbon
(b)	Cu(II) oxide	(ii)	Sulphur
(c)	Silver nitrate	(iii)	N, S, P and halogen
(d)	The sodium fusion extract gives black precipitate with acetic acid & lead acetate	(iv)	Halogen Specifically

The correct match is:

(A) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

(B) (a)-(i), (b)-(iv), (c)-(iii), (d)-(ii)

(C) (a)-(iii), (b)-(i), (c)-(ii), (d)-(iv)

(D) (a)-(i), (b)-(ii), (c)-(iv), (d)-(iii)

3. For a mixture of two volatile, completely miscible liquids A and B, with $P_A^\circ = 500$ torr and $P_B^\circ = 800$ torr, What is the composition of last droplet of liquid remaining in equilibrium with vapour?

Provided the initial ideal solution has a composition of $x_A = 0.6$and $x_B = 0.4$

(A) $x_A = 0.6; x_B = 0.4$

(B) $x_A = 0.5; x_B = 0.5$

(C) $x_A = 0.7; x_B = 0.3$

(D) $x_A = 0.3; x_B = 0.7$

1. निम्न में से कौनसा न्यूनतम चतुर्थ आयनन एन्थैल्पी IE_4 रखेगा ?

(A) La^{4+}

(B) Gd^{4+}

(C) Lu^{4+}

(D) Sm^{+3}

2. सूची-I को सूची-II के साथ सुमेल कीजियेः-

सूची-I परीक्षण/ अभिकर्मक/प्रेक्षण		सूची-II प्राप्त स्पीशीज	
(a)	लैसाने परीक्षण	(i)	कार्बन
(b)	Cu(ii) ऑक्साइड	(ii)	सल्फर
(c)	सिल्वर नाइट्रेट	(iii)	N,S,P तथा हैलोजन
(d)	सोडियम संगलन निष्कर्षण एसीटिक अम्ल तथा लेड एसीटेट के साथ काला अवक्षेप देता है	(iv)	विशेषतौर पर हैलोजन

(A) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

(B) (a)-(i), (b)-(iv), (c)-(iii), (d)-(ii)

(C) (a)-(iii), (b)-(i), (c)-(ii), (d)-(iv)

(D) (a)-(i), (b)-(ii), (c)-(iv), (d)-(iii)

3. $P_A^\circ = 500$ torr तथा $P_B^\circ = 800$ torr के दो वाष्पशील, पूरी तरह से विलय द्रवो A और B के मिश्रण के लिए वाष्प के साथ साम्य में शेष द्रव की अंतिम बूंद का संघटन क्या है? दिया गया है कि प्रारंभिक आदर्श विलयन का संघटन $x_A = 0.6$ और $x_B = 0.4$ रखता है।

(A) $x_A = 0.6; x_B = 0.4$

(B) $x_A = 0.5; x_B = 0.5$

(C) $x_A = 0.7; x_B = 0.3$

(D) $x_A = 0.3; x_B = 0.7$

4. Which of the following statements are incorrect ?

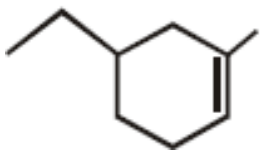
(A) SO_3 is a stronger oxidising agent and more, acidic than SO_2.

(B) Options A&C both are correct

(C) The acidic strength and oxidizing power of oxo-acids are greater in +6 oxidation state than in +4 oxidation state.

(D) The thermal stability of oxides of group 16 elements decreases in the order. $SO_2 > SeO_2 > TeO_2 > PoO_2$

5. What is the IUPAC name of the compound shown below



(A) 2-methyl-4-ethyl cyclohexene

(B) 5-ethyl-1-methyl cyclohexene

(C) 3-ethyl-1-methyl cyclohexene

(D) 2-ethyl-4-methyl cyclohexene

6. The sodium salt of a certain weak monobasic organic acid is hydrolysed to an extent of 3 % in its 0.1 M solution at $25^{\circ}C$. Given that the ionic product of water is 10^{-14} at the temperature, what is the dissociation constant of the acid ?

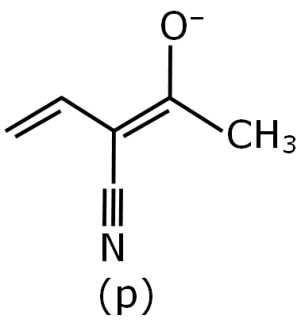
(A) $\approx 1 \times 10^{-10}$

(B) $\approx 1 \times 10^{-9}$

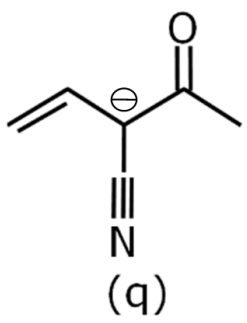
(C) 3.33×10^{-9}

(D) 3.33×10^{-10}

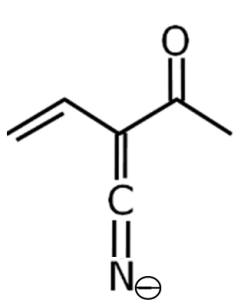
7. Compare relative stability of following resonating structure :



(p)



(q)



(r)

(A) p>q>r

(B) q>p>r

(C) q>r>p

(D) p>r>q

4. निम्न कथनो में से कौनसा गलत है?

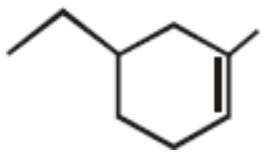
(A) SO_3 एक प्रबल ऑक्सीकारक घटक है तथा SO_2 की तुलना में अधिक अम्लीय है

(B) विकल्प A और C दोनों सही है

(C) ऑक्सी अम्लो की अम्लीय क्षमता तथा ऑक्सीकारक क्षमता +6 ऑक्सीकरण अवस्था में +4 ऑक्सीकरण अवस्था की तुलना में अधिक होती है

(D) वर्ग 16 के तत्वो के ऑक्साइडो का तापीय स्थायित्व निम्न क्रम में घटता है- $SO_2 > SeO_2 > TeO_2 > PoO_2$

5. नीचे दर्शाये गये यौगिक का IUPAC नाम क्या है



(A) 2-मेथिल-4-एथिल साइक्लोहेक्सीन

(B) 5-एथिल-1-मेथिल साइक्लोहेक्सीन

(C) 3-एथिल-1-मेथिल साइक्लोहेक्सीन

(D) 2-एथिल-4-मेथिल साइक्लोहेक्सीन

6. $25^{\circ}C$ पर एक दुर्बल एकक्षारीय कार्बनिक अम्ल का सोडियम लवण इसके 0.1 M विलयन में 3% तक जलअपघटित होता है, दिया गया है कि इस ताप पर जल का आयनिक गुणनफल 10^{-14} है, तो अम्ल का वियोजन नियतांक क्या है?

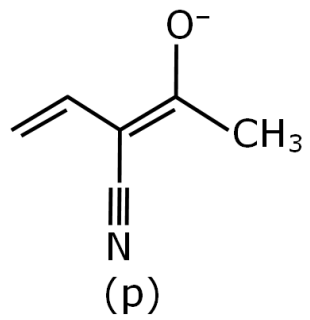
(A) $\approx 1 \times 10^{-10}$

(B) $\approx 1 \times 10^{-9}$

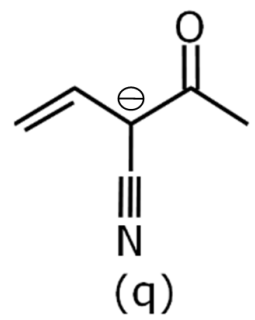
(C) 3.33×10^{-9}

(D) 3.33×10^{-10}

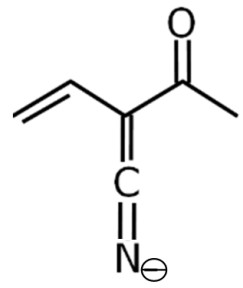
7. निम्न अनुनादी संरचना के स्थायित्व का क्रम है



(p)



(q)



(r)

(A) p>q>r

(B) q>p>r

(C) q>r>p

(D) p>r>q

8. Which of the following statement are false regarding interhalogens:

(A) Thermal stability order IF < ClF < BrF

(B) Hydrolysis of IF_7 produces H_5IO_6 and HF as products.

(C) Interhalogen compounds are diamagnetic in nature.

(D) IF_7 have Pentagonal bipyramidal structure

9. Chromium metal can be plated out from an acidic solution containing CrO_3 according to the following equation.

CrO_3 (aq) + $6H^+$ (aq) + $6e^- \rightarrow Cr(s) + 3H_2O$

How many of chromium (g) will be plated out 24,000 C ;

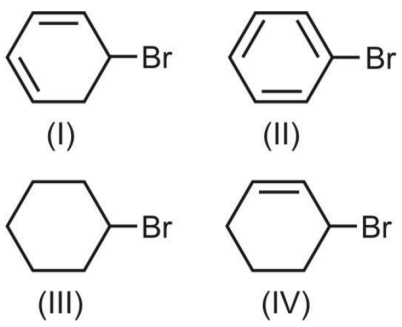
(A) 3.15gm

(B) 2.15g

(C) 4.15g

(D) None

10. The increasing order of rate of hydrolysis of the following compounds by SN_1 mechanism is



(A) II < I < III < IV

(B) I < IV < III < II

(C) II < III < IV < I

(D) II < III < I < IV

11. The number of P–O–P bonds in $H_4P_2O_7$, $(HPO_3)_3$ and P_4O_{10} are respectively.

(A) 1, 3, 6

(B) 0, 3, 6

(C) 0, 3, 4

(D) 1, 2, 4

12. For the first-order reaction T_{av} (average life), T_{50} and T_{75} in the increasing order are :

(A) $T_{50} < T_{av} < T_{75}$

(B) $T_{50} < T_{75} < T_{av}$

(C) $T_{av} < T_{50} < T_{75}$

(D) $T_{av} = T_{50} < T_{75}$

8. निम्न में से कौनसा आंतरिक हैलोजन तत्वो के संबंध में सही नहीं है ?

(A) तापीय स्थायित्व क्रम IF < ClF < BrF

(B) IF_7 का जलयोजन उत्पाद के रूप में H_5IO_6 और HF देता है |

(C) आंतरिक हैलोजन तत्व प्रकृति में प्रतिचुंबकिय होते है

(D) IF_7 की संरचना पंचकोणीय द्विपिरामिड है

9. क्रोमियम धातु को CrO_3 युक्त एक अम्लीय विलयन से निम्न समीकरण के अनुसार निकाला गया CrO_3 (aq) + $6H^+$ (aq) + $6e^- \rightarrow Cr(s) + 3H_2O$

24,000 C से कितनी क्रोमियम निकाली गयी

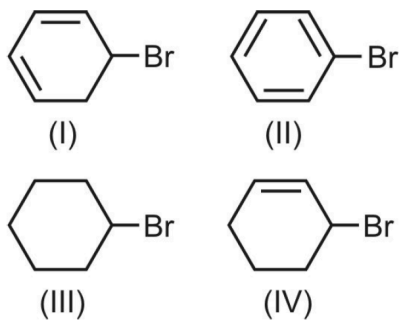
(A) 3.15gm

(B) 2.15g

(C) 4.15g

(D) कोई नहीं

10. SN_1 विधि द्वारा निम्न यौगिको के जलअपघटन की दर का बढ़ता क्रम है -



(A) II < I < III < IV

(B) I < IV < III < II

(C) II < III < IV < I

(D) II < III < I < IV

11. $H_4P_2O_7$, $(HPO_3)_3$ एवं P_4O_{10} में P–O–P आबन्धों की संख्या है, क्रमशः-

(A) 1, 3, 6

(B) 0, 3, 6

(C) 0, 3, 4

(D) 1, 2, 4

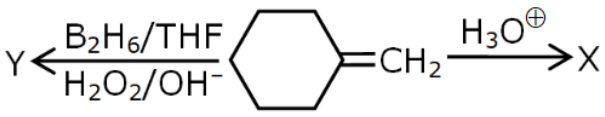
12. प्रथम कोटि की अभिक्रिया के लिए T_{av} (औसत आयु), T_{50} तथा T_{75} का बढ़ता हुआ क्रम है।

(A) $T_{50} < T_{av} < T_{75}$

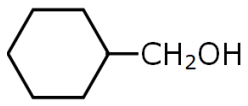
(B) $T_{50} < T_{75} < T_{av}$

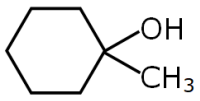
(C) $T_{av} < T_{50} < T_{75}$

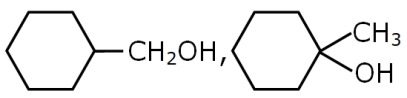
(D) $T_{av} = T_{50} < T_{75}$

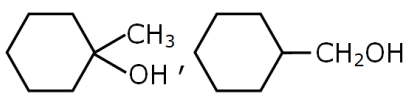
13. 

X and Y are respectively.

(A) Both 

(B) Both 

(C) 

(D) 

14. Pick out the correct statement : –

(A) Atomic radius of Cl in Cl_2 and NaCl is same

(B) In general, density down the groups decreases

(C) Melting point of covalent solids is greater than molecular solids

(D) Z_{eff} in the period of normal elements increases in the magnitude of 0·15

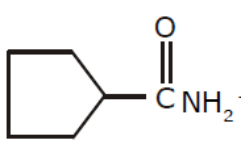
15. The sodium salt of methyl orange contains 7% of sodium. What is the minimum molecular weight of the compound (atomic weight of Na = 23) :–

(A) 825

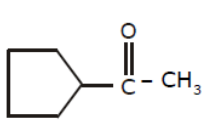
(B) 359

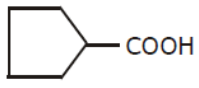
(C) 442

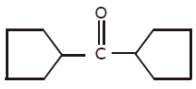
(D) 329

16. 

$\xrightarrow[\Delta]{P_2O_5}$ W $\xrightarrow[H_3O^{\oplus}]{CH_3MgBr}$ X $\xrightarrow[(yellowppt.+y)]{Ca(OH)_2.1_2}$ Y $\xrightarrow[\Delta]{}$ Z, Z is :

(A) 

(B) 

(C) 

(D) 

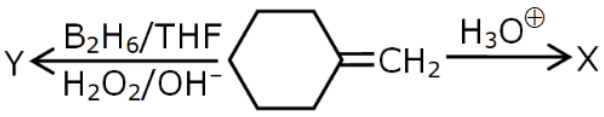
17. The correct order of acidic strength of these hydra acids is :

(A) HCl < HBr < HI < HF

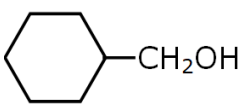
(B) $CH_4 < SiH_4 < GeH_4$

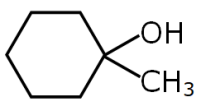
(C) $NH_3 < CH_4 < H_2O < HF$

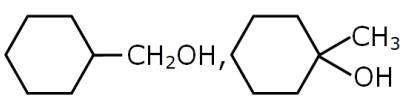
(D) HBr < H_2S < NH_3

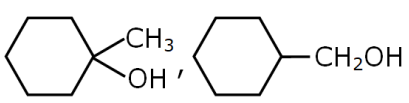
13. 

क्रमशः X तथा Y है

(A) दोनो 

(B) दोनो 

(C) 

(D) 

14. सही कथन का चयन कीजिए-

(A) Cl_2 तथा NaCl में Cl की परमाण्विक त्रिज्या समान है

(B) वर्ग में नीचे जाने पर सामान्यतः घनत्व घटता है

(C) सहसंयोजी ठोसो के गलनांक आण्विक ठोसो की तुलना में अधिक होते है

(D) सामान्य तत्वों के आवर्त में Z_{eff}, 0·15 के परिमाण में बढ़ता है

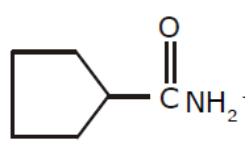
15. मेथिल ऑरेंज के सोडियम लवण में 7% सोडियम होता है। यौगिक का न्यूनतम आण्विक भार क्या होगा (Na का परमाणु भार = 23) : -

(A) 825

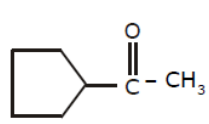
(B) 359

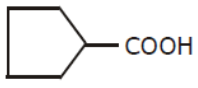
(C) 442

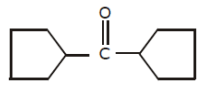
(D) 329

16. 

$\xrightarrow[\Delta]{P_2O_5}$ W $\xrightarrow[H_3O^{\oplus}]{CH_3MgBr}$ X $\xrightarrow[(yellowppt.+y)]{Ca(OH)_2.1_2}$ Y $\xrightarrow[\Delta]{}$ Z, Z है :

(A) 

(B) 

(C) 

(D) 

17. निम्न हाइड्रा अम्लो की अम्लीय सामर्थ्य का सही क्रम है

(A) HCl < HBr < HI < HF

(B) $CH_4 < SiH_4 < GeH_4$

(C) $NH_3 < CH_4 < H_2O < HF$

(D) HBr < H_2S < NH_3

18. Listed in the table are forward and reverse rate constants for the reactions

$2NO(g) \rightleftharpoons N_2(g) + O_2(g)$

Temperature (K)	$k_f(M^{-1}S^{-1})$	$k_r(M^{-1}s^{-1})$
1400	0.29	1.1×10^{-6}
1500	1.3	1.4×10^{-5}

Is the reaction endothermic or exothermic? Explain in terms of kinetics.

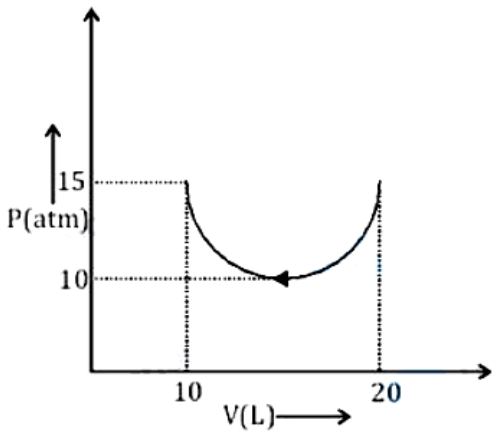
(A) Endothermic

(B) exothermic

(C) can be both

(D) can't say

19. The total work done in the following PV curve is



(A) $\left(150 - \frac{25\pi}{2}\right)L - atm$

(B) $\left(150 + \frac{25\pi}{2}\right)L - atm$

(C) $\left(-\frac{25\pi}{2}\right)L - atm$

(D) $150\ L - atm$

20. Match the coordination given in Column I with the central metal atoms given in Column II and assign the correct code.

Column I (Coordination compound)	**Column II** (Central metal atom)
A. Chlorophyll	1. Rhodium
B. Blood pigment	2. Cobalt
C. Wilkinson's catalyst	3. Magnesium
D. Vitamin B12	4. Iron
	5.Calcium

(A) A-2,B-3.C-4,D-1

(B) A-3,B-4.C-1,D-2

(C) A-4,B-1.C-5,D-2

(D) A-5,B-4.C-3,D-1

18. $2NO(g) \rightleftharpoons N_2(g) + O_2(g)$ अभिक्रिया की अग्र और उत्क्रमणीय दर नियतांक निम्न है

ताप (K)	$k_f\left(M^{-1}S^{-1}\right)$	$k_r\left(M^{-1}s^{-1}\right)$
1400	0.29	1.1×10^{-6}
1500	1.3	1.4×10^{-5}

बताए अभिक्रिया उष्माशोषी है या उष्माक्षेपी ? बलगति के पदों में बताइए ।

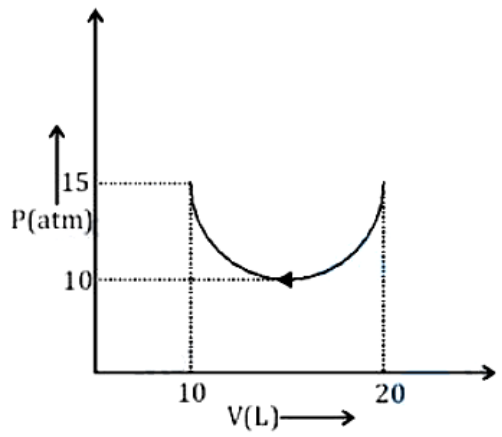
(A) ऊष्मा शोषी

(B) ऊष्मा क्षेपी

(C) दोनों में से कोई भी

(D) कह नहीं सकते

19. निम्न PVआरेख में किया गया कुल कार्य है-



(A) $\left(150 - \frac{25\pi}{2}\right)L - atm$

(B) $\left(150 + \frac{25\pi}{2}\right)L - atm$

(C) $\left(-\frac{25\pi}{2}\right)L - atm$

(D) $150\ L - atm$

20. कॉलम I में दिए गए संकुल यौगिक को कॉलम II में दिए गए केंद्रीय धातु परमाणुओं से मिलाएं और सही कोड निर्दिष्ट करें।

कॉलम I (संकुल यौगिक)	**कॉलम II** (केंद्रीय धातु परमाणु)
A. क्लोरोफिल II	1. रोडियम
B. रक्त वर्णक	2. कोबॉल्ट
C. विल्किनसन उत्प्रेरक	3. मैग्नेशियम
D. विटामिन B12	4. आयरन
	5.कैल्शियम

(A) A-2,B-3.C-4,D-1

(B) A-3,B-4.C-1,D-2

(C) A-4,B-1.C-5,D-2

(D) A-5,B-4.C-3,D-1

CHEMISTRY

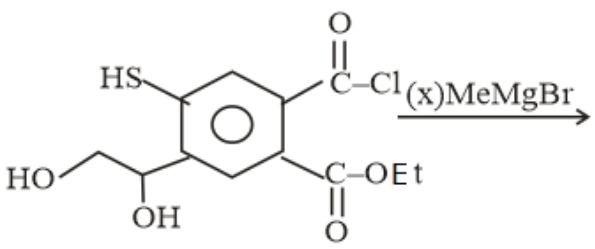
SECTION - B

[NUMERIC VALUE TYPE]

Q.21 to ***Q.25*** are ***NUMERIC VALUE TYPE*** Questions. The answer to each question is a **NUMERICAL VALUE.**

21. The number of chiral carbon atoms in β –D–(+) glucopyranose is :

22.



Then 'x' will be :

23. In how many of the following triatomic molecules/ions, the linear molecules (s)/ion(s) are where the hybridization of the central atom does not have contribution from the d-orbital(s).

$BeCl_2$, N_3^-, I_3^-, XeF_2, CO_2, SO_2, ICl_2^-, $SnCl_2$ and BeF_2

24. The standard enthalpies of formation of Al_2O_3 and CaO are –1675 kJ mol^{-1} and –635 kJ mol^{-1} respectively.

For the reaction

$3CaO + 2Al \rightarrow 3Ca + Al_2O_3$ the standard reaction enthalpy $\triangle_r H^0$=_____ kJ.

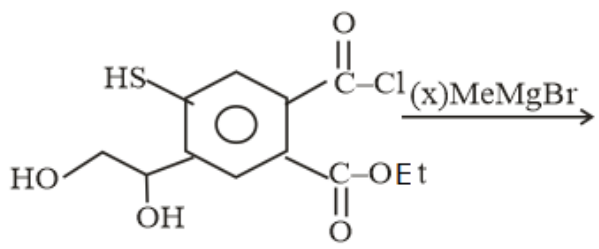
(Round off to the Nearest Integer)

(Divide your answer by 10)

25. The value of 'X' in the compound $Ca_xAl_{12}Si_{24}O_{72}$ is :

21. β –D–(+) ग्लुकोपायरेनोस में किरैल कार्बन परमाणुओं की संख्या है:-

22.



तब 'x' होगा :

23. निम्न में से कितने त्रिपरमाण्विक अणुओं/आयनों में, रेखीय अणु/आयन हैं, जिनके केन्द्रीय परमाणु के संकरण में **d-** कक्षकों का योगदान नही होता है।

$BeCl_2$, N_3^-, I_3^-, XeF_2, CO_2, SO_2, ICl_2^-, $SnCl_2$ तथा BeF_2

24. Al_2O_3 तथा CaO के निर्माण की मानक एन्थैल्पियाँ क्रमशः –1675 kJ mol^{-1} तथा –635 kJ mol^{-1} है। अभिक्रिया $3CaO + 2Al \rightarrow 3Ca + Al_2O_3$ के लिये मानक अभिक्रिया एन्थैल्पी $\triangle_r H^0$=_____ kJ. है। (निकटतम पूर्णांक में)

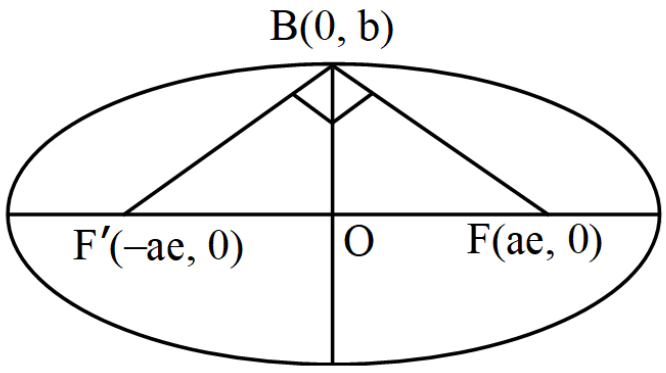
(अपने उत्तर को 10 से विभाजित करे)

25. यौगिक $Ca_xAl_{12}Si_{24}O_{72}$ में 'X' का मान है :

Maths - Section A

1. Answer: A

Sol:



Using pythagoras for triangle F'BF,

$a^2e^2 + b^2 + a^2e^2 + b^2 = 4a^2e^2$

$\Rightarrow b^2 = a^2e^2$

And $e^2 = 1 - \frac{b^2}{a^2}$

$\Rightarrow a^2e^2 = a^2 - b^2$

$\Rightarrow a^2e^2 = a^2 - a^2e^2$

$\Rightarrow 2a^2e^2 = a^2$

$\Rightarrow e = \frac{1}{\sqrt{2}}$

Hence, option (A) is correct

2. Answer: B

Sol:

Let $\left(\sqrt{t}, t\right)$ be a point on the parabola whose distance from (0, c), be d. Then

$z = d^2 = t + (t-c)^2 = t^2 + t(1-2c) + c^2$

$\Rightarrow \frac{dz}{dt} = 2t + 1 - 2c, \frac{d^2z}{dt^2} = 2 > 0$

Now $\frac{dz}{dt} = 0 \Rightarrow t = c - 1/2$

which gives the minimum distance. So

min. distance = $\sqrt{(c - 1/2) + (-1/2)^2}$

= $\sqrt{c - 1/4}$

3. **Answer:** B

Sol:

Since $D < 0$. $\therefore$ x^2 + 3x +5 = 0 have imaginary roots which are always occurs in pair.

$\Rightarrow x^2 + 3x + 5 = 0$ and $ax^2 + bx + c = 0$ have both roots common

$\Rightarrow \frac{a}{1} = \frac{b}{3} = \frac{c}{5}$

Minimum value of $(a + b + c)$ = 1 + 3 + 5

$(a + b + c)$ = 9

4. **Answer:** C

Sol:

$$\lim_{n\to\infty}\left(\sqrt{n^2 - n - 1} + n\alpha + \beta\right) = 0$$

Put $n = \frac{1}{t}$

$$\lim_{t\to 0}\left(\sqrt{\frac{1}{t^2} - \frac{1}{t} - 1} + \frac{\alpha}{t} + \beta\right) = 0$$

$$\lim_{t\to 0} \frac{\sqrt{1-t-t^2}+\alpha+\beta t}{t} = 0$$

$1 + \alpha = 0 \Rightarrow \alpha = -1$ $\left(\frac{0}{0}\right)$ form

Diff use L-Hospital rule

$$\lim_{t\to 0} \frac{-1-2t}{2\sqrt{1-t-t^2}} + \beta = 0$$

$-\frac{1}{2} + \beta = 0 \Rightarrow \beta = \frac{1}{2}$

Now $8(\alpha + \beta) = 8\left(-1 + \frac{1}{2}\right) = -4$

5. **Answer:** A

Sol:

Slope of BC = tan (90 − θ) = $\frac{3}{5-a}$

$\Rightarrow$ cot θ = $\frac{3}{5-a}$ ...(1)

Slope of AB = tan (90 + θ) = $\frac{2}{1-a}$

$\Rightarrow$ − cot θ = $\frac{2}{1-a}$ ...(2)

from (1) & (2) $\frac{3}{5-a} = \frac{2}{a-1}$

$\Rightarrow$ a = $\frac{13}{5}$

$\Rightarrow A(1, 2) \& B\left(\frac{13}{5}, 0\right)$

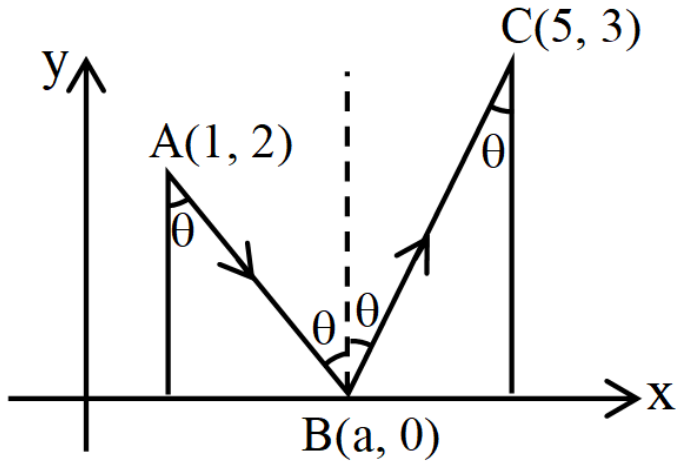
$\Rightarrow m = -\frac{5}{4}$

Equation of line AB is

$\Rightarrow y - 2 = -\frac{5}{4}(x-1)$

$\Rightarrow 4y - 8 + 5x - 5 = 0$

$\Rightarrow 5x + 4y = 13$



Therefore, the correct answer is (A)

6. **Answer:** A

Sol:

$\frac{xdy}{dx} - y = \sqrt{y^2 + 16x^2}$

$\frac{dy}{dx} = \frac{y+\sqrt{y^2+16x^2}}{x}$

Let y = vx

$\frac{dy}{dx} = v + x\frac{dv}{dx}$

$= v + x\frac{dv}{dx} = \frac{vx+\sqrt{v^2x^2+16x^2}}{x}$

$\int \frac{dv}{\sqrt{v^2+16}} = \int \frac{dx}{x}$

$\ell n\left|v + \sqrt{v^2 + 16}\right| = \ln x + \ln C$

$\frac{y}{x} + \frac{\sqrt{y^2+16x^2}}{x} = Cx$

$y + \sqrt{y^2 + 16x^2} = Cx^2$

$y + \sqrt{y^2 + 16x^2} = Cx^2$

y(1) = 3

C = 8

$y + \sqrt{y^2 + 16x^2} = 8x^2$

at x = 2

$y + \sqrt{y^2 + 64} = 32$

$y^2 + 64 = \left(32 - y\right)^2$

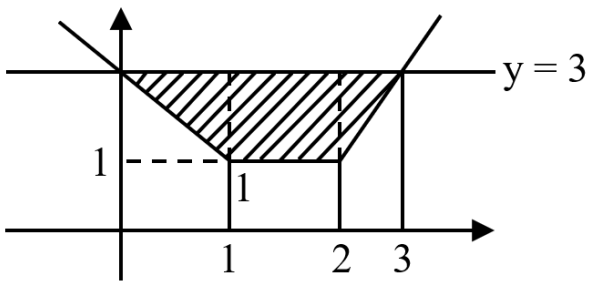
$y^2 + 64 = y^2 - 64y + \left(32\right)^2$

64 (1+ y) = 32 × 32

y(2) = 15

7. **Answer:** B

Sol:



$A = \frac{1}{2}\left[1 + 3\right]\left[2\right]$

$= 4$

8. **Answer:** D

Sol:

$$I = \int_0^1 e^{2x-[2x]}\, d(x-[x])$$

$\because \quad 0 < x < 1 \Rightarrow [x] = 0$

$$= \int_0^1 e^{\{2x\}}\, dx$$

$$\text{put } 2x = t \Rightarrow dx = \frac{dt}{2}$$

$$= \frac{1}{2}\int_0^2 e^{\{t\}}\, dt$$

We know that

{x} is a periodic function with period 1, From Property – 8

$$= \frac{1}{2} \times 2\int_0^1 e^{\{t\}}\, dt$$

$0 < t < 1 \Rightarrow \{t\} = t$

$$= \int_0^1 e^{t}\, dt$$

$$= e - 1$$

Alternative Method

$$I = \int_0^1 e^{2x-[2x]}\, d(x-[x])$$

$\because \quad 0 < x < 1 \Rightarrow [x] = 0$

$$= \int_0^1 e^{\{2x\}}\, dx$$

$$\text{put } 2x = t \Rightarrow dx = \frac{dt}{2}$$

$$= \frac{1}{2}\int_0^2 e^{\{t\}}\, dt$$

$$= \frac{1}{2}\left[\int_0^1 e^{t}\, dt + \int_1^2 e^{t-1}\, dt\right]$$

$$= \frac{1}{2}\left[e^{t}\Big|_0^1 + e^{t-1}\Big|_1^2\right]$$

$$= \frac{1}{2}[(e-1)+(e-1)] = e - 1$$

9. Answer: D

Sol:

Reflexive : $(a, a) \Rightarrow \gcd$ of $(a,\ a) = 1$

which is not true for every $a \in Z$.

Hence, R is not reflexive

Symmetric:
Take $a = 2,\ b = 1 \Rightarrow \gcd(2, 1) = 1$
Also $2a = 4 \neq b$
Now when $a = 1,\ b = 2 \Rightarrow \gcd(1, 2) = 1$
Also now $2a = 2 = b$
Hence $a = 2\ b$
is not Symmetric

Transitive:
Let $a = 3,\ b = 5, c = 9$
$\gcd(a, b) = 1$
$\gcd(b, c) = 1$
$\gcd(a, c) = 3$
Hence not transitive
$\Rightarrow R$ is neither symmetric nor transitive.

10. Answer: C

Sol:

Let the circle cuts the x – axis and y– axis at

A and B respectively. If O is the origin,

then ΔAOB = 90º, and

A (5,0); B (0,5) is the diameter of the circle.
Then using diameter form of equation of circle,

we get
(x – 5) (x – 0) + (y – 0) (y – 5) = 0

$\Rightarrow x^2 + y^2 - 5x - 5y = 0$

11. Answer: C

Sol:

$\overline{z}_1 = i\ \overline{z}_2$

$z_1 = -i\ z_2$

$arg\left(\frac{z_1}{\overline{z}_2}\right) = \pi$

$arg\left(-i\ \frac{z_2}{\overline{z}_2}\right) = \pi,$

$arg(z_2) = \theta$

$\frac{-\pi}{2} + \theta + \theta = \pi$

$2\theta = \frac{3\pi}{2}$

$\arg(z_2) = \theta = \frac{3\pi}{4}, \arg\ z_1 = \frac{\pi}{4}$

12. **Answer:** D

Sol:

GP = a, ar, ar^2

$\because$ $a + ar + ar^2 = 14$ &

$a^2 + a^2r^2 + a^2r^4 = 84$

$\Rightarrow a\left(1+r+r^2\right)=14$ and

$a^2\left(1+r^2+r^4\right)=84$

$\Rightarrow a\left(1+r+r^2\right)=14$ and

$a\left(1+r+r^2\right)a\left(1-r+r^2\right)=84$

$\Rightarrow a\left(1+r+r^2\right)=14$ ...(1) and

$a\left(1-r+r^2\right)=6$ ...(2)

$\frac{a\left(1+r+r^2\right)}{a\left(1-r+r^2\right)}=\frac{14}{6}$

$6\left(1+r+r^2\right)=14\left(1-r+r^2\right)$

$2r^2-5r+2=0$

$2r(r-2)-1(r-2)=0$

$r=2\ ,\ r=\frac{1}{2}$

if $r=2\ ,\ a=2$

$\therefore$ GP : 2, 4, 8

if $r=\frac{1}{2}\ ,\ a=8$

GP: 8 , 4 , 2

13. **Answer:** A

Sol:

$6^{83}+8^{83}=(1+7)^{83}+(7-1)^{83}$

$=(1+7)^{83}-(1-7)^{83}$

$=2\left[\begin{matrix}{}^{83}C_1\cdot 7+{}^{83}C_3\cdot 7^3+\ldots\ldots\ldots\ldots\\ +{}^{83}C_{83}\cdot 7^{83}\end{matrix}\right]$

$=(2\cdot 7\cdot 83)+49I$ where I an integer

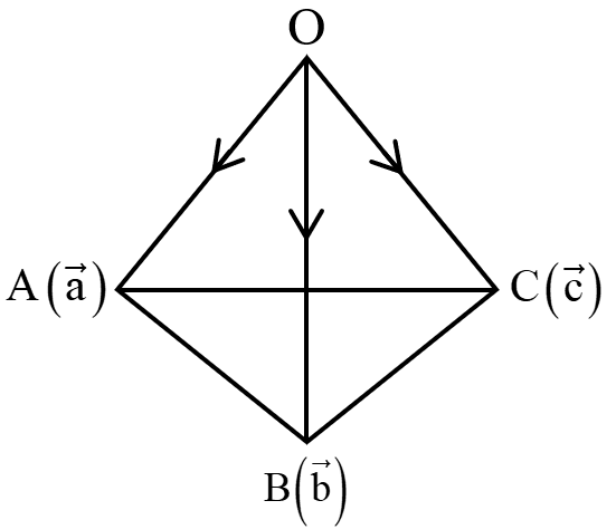
$\therefore 14\times 83=1162$

$\frac{1162}{49}=23\frac{35}{49}$

$\therefore$ remainder is 35 Ans.

14. Answer: A

Sol:



Let $\vec{a}_1$ be the vectors whose magnitude is equal to the areas of face f_1 (OAB)

$\vec{a}_2$ be the vectors whose magnitude is equal to the areas of f_2 (OBC)

$\vec{a}_3$ be the vectors whose magnitude is equal to the areas of f_3 OCA

$\vec{a}_4$ be the vectors whose magnitude is equal to the areas of f_4 ABC

$$\vec{a}_1 = \frac{1}{2}\left(\vec{a} \times \vec{b}\right)$$

$$\vec{a}_2 = \frac{1}{2}\left(\vec{b} \times \vec{c}\right)$$

$$\vec{a}_3 = \frac{1}{2}\left(\vec{c} \times \vec{a}\right)$$

$$\vec{a}_4 = \frac{1}{2}\left(\vec{c} - \vec{a}\right) \times \left(\vec{b} - \vec{a}\right)$$

$$\vec{a}_1 + \vec{a}_2 + \vec{a}_3 + \vec{a}_4 = 0$$

Therefore, the correct answer is (A)

15. Answer: C

Sol:

$$|\text{adj}(AB)| = |AB|^2$$

$$\left|(\text{adj}\, AB)^{-1}\right| = \left|\text{adj}\, AB\right|^{-1}$$

$$\left|\text{adj}\,(AB)^{-1}\right| = \left|(AB)^{-1}\right|^2 = \left|AB\right|^{-2}$$

$$\left|\text{adj}\,(AB)^{-1}\right| = \left|\text{adj}\, AB\right|^{-1}$$

$$= \left(|AB|^2\right)^{-1} = |AB|^{-2}$$

$$\left|\text{adj}(AB)^T\right| = \left|(AB)^T\right|^2 = \left|AB\right|^2$$

16. Answer: C

Sol:

Since, $\tan^{-1}\mathrm{x}$ and $\cot^{-1}\mathrm{x}$ exists for all $\mathrm{x} \in \mathrm{R}$ and $\cos^{-1}(2-\mathrm{x})$ exist if $-1 \leq 2-\mathrm{x} \leq 1$

$\Rightarrow 1 \leq \mathrm{x} \leq 3$

Thus, the domain of the given function is $[1,3]$.

17. Answer: B

Sol:

We know that,

$\left|\mathrm{A}^{-1}\right| = \frac{1}{|\mathrm{A}|}$

$\left|\operatorname{adj} \mathrm{A}\right| = \left|\mathrm{A}\right|^{2}$ (for 3×3 matrices)

$\left|\mathrm{A}^{-1} \operatorname{adj}\left(\mathrm{B}^{-1}\right) \operatorname{adj}\left(2\mathrm{A}^{-1}\right)\right|$

$= \frac{1}{|\mathrm{A}|} \times \left|\mathrm{B}^{-1}\right|^{2} \times \left|2\mathrm{A}^{-1}\right|^{2}$

$= \frac{1}{|\mathrm{A}|} \times \frac{1}{|\mathrm{B}|^{2}} \times \left(2^{3}\right)^{2} \times \frac{1}{|\mathrm{A}|^{2}}$

$= \frac{2^{6}}{-2^{5}} = -2$

18. Answer: C

Sol:

f(x) = [6x + 7] + $\cos\pi\mathrm{x} - 6\mathrm{x}$

$\Rightarrow \quad \mathrm{f}(\mathrm{x}) = [6\mathrm{x}+7] +$

$\cos\pi\mathrm{x} - (6\mathrm{x}+7) + 7$

$\Rightarrow \quad \mathrm{f}(\mathrm{x}) = -\{6\mathrm{x}+7\} + \cos\pi\mathrm{x} + 7$

Thus period of $\{6\mathrm{x}+7\}$ is $\frac{1}{6}$ and period of $\cos\pi\mathrm{x}$ is 2.

Hence period of f is = L.C.M. is $\frac{1}{6}$ and 2 = 2

19. Answer: B

Sol:

Here, $\frac{dx}{dy} = \left(\frac{dy}{dx}\right)^{-1}$

Differentiating both sides w.r.t. y, we get

$$\frac{d^2x}{dy^2} = -\left(\frac{dy}{dx}\right)^{-2} \cdot \frac{d}{dy} \cdot \left(\frac{dy}{dx}\right)$$

$$= -\left(\frac{dy}{dx}\right)^{-2} \cdot \frac{d}{dy}\left(\frac{dy}{dx}\right) \cdot \frac{dx}{dx}$$

$$= -\left(\frac{dy}{dx}\right)^{-2} \cdot \frac{d}{dx} \cdot \left(\frac{dy}{dx}\right) \cdot \frac{dx}{dy}$$

$$= -\left(\frac{dy}{dx}\right)^{-2} \cdot \frac{d^2y}{dx^2} \cdot \left(\frac{dy}{dx}\right)^{-1}$$

$$= -\left(\frac{dy}{dx}\right)^{-3} \cdot \left(\frac{d^2y}{dx^2}\right)$$

20. Answer: B

Sol:

$$= \frac{(\cos\ 6x+\cos\ 4x)+5(\cos 4x+\cos\ 2x) \\ +10(\cos 2x+1)}{\cos\ 5x+5\cos\ 3x+10\cos x}$$

$$= \frac{2\cos\ 5x\ \cos\ x+10\cos 3x\ \cos\ x+20\ \cos^2 x}{\cos\ 5x+5\cos\ 3x+10cosx}$$

$$= \frac{2\cos\ x[\cos\ 5x+5\ \cos\ 3x+10\ \cos\ x]}{[\cos\ 5x+5\cos\ 3x+10\ cosx]}$$

$= 2\ \cos x$

Maths - Section B

21. Answer: 3

Sol:

let point $A(3, 7, -7)$

$3\hat{i} + 7\hat{j} - 7\hat{k}$

$\frac{x-2}{-3} = \frac{y-3}{2} = \frac{z+2}{1}$

point $B(2, 3, -2)$

$2\hat{i} \ + 3\hat{j} - 2\hat{k}$

$\overrightarrow{\mathrm{BA}} = \left(3\hat{\mathrm{i}} + 7\hat{\mathrm{j}} - 7\widehat{\mathrm{k}}\right) - \left(2\hat{\mathrm{i}} + 3\hat{\mathrm{j}} - 2\widehat{\mathrm{k}}\right)$

$= \left(\hat{\mathrm{i}} + 4\hat{\mathrm{j}} - 5\widehat{\mathrm{k}}\right)$

$\overrightarrow{\mathrm{BA}} \times \overrightarrow{l} = \overrightarrow{\mathrm{n}} = \begin{vmatrix} \hat{\mathrm{i}} & \hat{\mathrm{j}} & \widehat{\mathrm{k}} \\ -3 & 2 & 1 \\ 1 & 4 & -5 \end{vmatrix}$

$\mathrm{a}\hat{\mathrm{i}} + \mathrm{b}\hat{\mathrm{j}} + \mathrm{c}\widehat{\mathrm{k}} = -14\hat{\mathrm{i}} - \hat{\mathrm{j}}\left(14\right) + \widehat{\mathrm{k}}\left(-14\right)$

a = 1, b = 1, c = 1

Plane is (x – 2) + (y – 3) + (z + 2) = 0

x + y + z –3 = 0

$\mathrm{d} = \sqrt{3} \Rightarrow \mathrm{d}^2 = 3$

22. Answer: 12

Sol:

As given in the question

No. of boys = 6

No. of girls = 6

Now,

No. of ways to arrange them in line

X = 6! 6! + 6! 6!

X = 2.6! 6!

No. of ways to arrange them in circle

Y = (6–1)! 6! = 5!6!

$\therefore \frac{X}{Y} = \frac{2.6!6!}{6!5!} = \frac{2\times6}{1}$

$\frac{X}{Y} = 12$

23. Answer: 0

Sol:

Given function $f(x) = |x-1| + |x-2| + \cos\ x$ can be seen as sum of three functions $y_1 = |x-1|$, $y_2 = |x-2|$ and $y_3 = \cos\ x$.

It is known that absolute value functions are continuous on it's domain, so function $y_1 = |x-1|$, and $y_2 = |x-2|$ are continuous.

Similarly, function $y_3 = \cos\ x$ is a trigonometric function, and all trigonometric functions are continuous. So $y_3 = \cos\ x$ is also continuous.

According to property of continuous function, sum or difference of continuous function will also be a continuous function.

Hence, given function $f(x) = |x-1| + |x-2| + \cos\ x$ is a continuous function.

So there are "0" number of points where function is not continuous.

24. Answer: 50

Sol:

$$P\left(\frac{A}{(A^c \cup B^c)}\right) = \frac{P(A \cap (A \cap B)^c)}{P((A \cap B)^c)}$$

$$= \frac{P(A \cap B^c)}{1 - P(A \cap B)}$$

$$= \frac{P(A) - P(A \cap B)}{1 - P(A \cap B)} =$$

$$\frac{\frac{4}{7} - \frac{3}{28}}{\frac{25}{28}} = \frac{13}{25} = \lambda$$

25. Answer: 9

Sol:

We have

$$f(x) = x^3 + 6x^2 + px + 7$$

$$\therefore f'(x) = 3x^2 + 12x + p < 0$$

$$\Rightarrow 3x^2 + 12x + p = k(x+3)(x+1)$$

$\therefore$ On comparing coefficients, we get

k =3 and p =3k

Hence p =9

Physics - Section A

1. Answer: B

Sol:

Initial horizontal velocity u = 360km/hr = 100 m/s

Initial vertical velocity = 0

Let the time taken to reach the ground between second vertical distance covered h = 1960m

$h = 1/2\ gt^2$

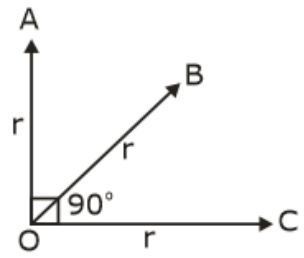
$t = \sqrt{\frac{2h}{g}}$

$R = 100t = 100\sqrt{\frac{2\times1960}{9.8}} = 2000\ m = 2\ km$

Therefore, the correct answer is (B)

2. Answer: C

Sol:

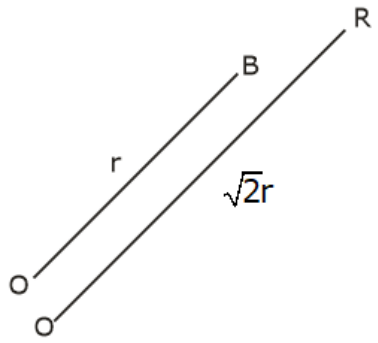


Let OR b_e the Resultant of A & C

So $\left|\overrightarrow{\mathrm{OR}}\right| = \sqrt{(\mathrm{OA})^2 + (\mathrm{OC})^2 + 2\left(\mathrm{OA}\right)\left(\mathrm{OC}\right)\cos\theta}$

$\left|\overrightarrow{\mathrm{R}}\right| = \sqrt{2}\,\mathrm{r}$

Angle of $\overrightarrow{\mathrm{OR}}$ with $\overrightarrow{\mathrm{OC}}$ is 45°



Angle b/w $\overrightarrow{\mathrm{OB}}$ & $\overrightarrow{\mathrm{OR}}$ is 0°

let $\overrightarrow{\mathrm{OX}}$ be the resultant of $\overrightarrow{\mathrm{OB}}$ & $\overrightarrow{\mathrm{OR}}$

so $\overrightarrow{\mathrm{OX}} = \sqrt{(\mathrm{OB})^2 + (\mathrm{OR})^2 + 2\left(\mathrm{OB}\right)\left(\mathrm{OR}\right)\cos 0^{\circ}}$

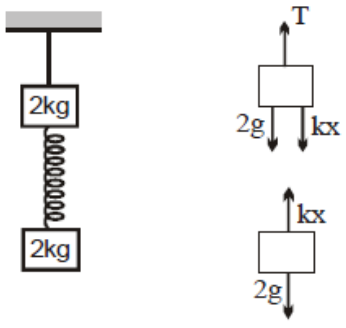
$\left|\overrightarrow{\mathrm{OX}}\right| = \sqrt{(\mathrm{r})^2 + \left(\sqrt{2\mathrm{r}}\right)^2 + 2\left(\sqrt{2}\mathrm{r}\right)(\mathrm{r}))}$

$\left|\overrightarrow{\mathrm{OX}}\right| = \left(r + \sqrt{2}\,r\right)$

$\left|\overrightarrow{\mathrm{OX}}\right| = \mathrm{r}\,(1+\sqrt{2})$

3. Answer: C

Sol:



From free body diagram

For lower block ,kx = 2g
Tension in the upper block ,

T = 2g + kx = 4g
as soon as the string is cut,
T disappears.

Let the upper block is

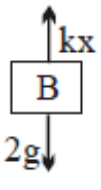
A and lower block is B.

For block A:

$\therefore$ acceleration

$\Rightarrow \frac{4g}{2}$ = 20 m/s^2

For block B:



$\Rightarrow$ no net force on block B.

Hence, acceleration of the block B will be 0 m/s^2.

4. **Answer:** B

Sol:

$V = 2t^2$

$\Rightarrow \frac{dv}{dt} = 4t$

tangential acceleration

$\therefore a_t = 4t$ at $t = 1$sec.

$a_t = 4\ m/s^2$

velocity at $t = 1$ sec.

$v = 2\ t^2$

$v = 2 \times (1)^2$

$= 2$

centripetal acceleration

$a_r = V^2/R = 4$

$a_{net} = \sqrt{(4)^2 + (4)^2}$

$= \sqrt{32}$

$= 4\sqrt{2}$

Therefore, the correct answer is (2)

5. **Answer:** B

Sol:

$\sqrt{x} = t - 3 \Rightarrow x = (t-3)^2$

$\Rightarrow$ speed $V = 2(t-3)$ [differentiating w.r.t. t]

if $t = o$,$v = -6$

if $t = 6$, $v = +6$

using work energy theorem

$\because W = \Delta K = K_f - K_i = 0$

6. **Answer:** A

Sol:

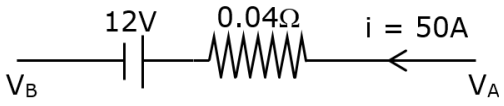
heigth attained by an object after striking a stationary object (surface)

$h_n = he^{2n} = 32\left(\frac{1}{2}\right)^4 = \frac{32}{16} = 2m$

(here $n = 2$, $e = 1/2$)

7. **Answer:** C

Sol:



$$V_A - 50 \times 0.04 - 12 = V_B$$

$$V_A - 2 - 12 = V_B$$

$$V_A - V_B = 14\ V$$

Potential difference across battery = $14\ V$.

Therefore, the correct answer is (C).

8. **Answer:** A

Sol:

It is a case of translation motion without rotation. The force should act at the centre of mass

$$Y_{cm} = \frac{(m \times 2l) + (2m \times l)}{m + 2m} = \frac{4l}{3}$$

(considering point C as origin)

9. **Answer:** B

Sol:

As we know, angular Impulse -

$$J = \int_{t_1}^{t_2} \tau \ dt$$

$$\tau = Fd\sin\theta$$
$$\Rightarrow \tau = Fd \ \ \{\because \text{Force is applied tangentially}\}$$

d = R = 0.5m

$$\therefore J = \int_0^2 \left(20t - 5t^2\right) \times 0.5 \, dt$$

$$\Rightarrow J = 0.5 \times \left[10t^2 - \frac{5t^3}{3}\right]_0^2$$

$$\Rightarrow J = 0.5 \times \frac{80}{3}$$

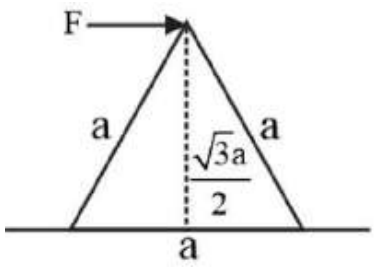
$$\Rightarrow J = \frac{40}{3} Nm - s$$

Hence, the correct answer is option (B)

10. Answer: A

Sol:

The prism will topple after normal reaction shifts to the rightmost part of the prism.



Hence, at that time, equating torque about the toppling point (rightmost point of the prism) due to force F and force due to gravity mg

$$F \times \left(\frac{a\sqrt{3}}{2}\right) = mg\,\frac{a}{2}$$

$$\Rightarrow F = \frac{mg}{\sqrt{3}}$$

Therefore, the correct answer is (A).

11. Answer: B

Sol:

When springs are in series,

$$k = \frac{k_1 k_2}{k_1 + k_2}$$

For first spring,

$$t_1 = 2\pi\sqrt{\frac{m}{k_1}}$$

For Second spring,

$$t_2 = 2\pi\sqrt{\frac{m}{k_2}}$$

$$\therefore\ t_1^2 + t_2^2 = \frac{4\pi^2\, m}{k_1} + \frac{4\pi^2\, m}{k_2}$$

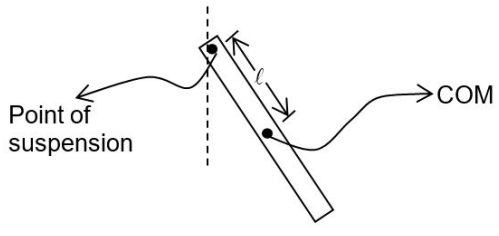
$$= 4\pi^2\, m\left(\frac{k_1 + k_2}{k_1 k_2}\right)$$

$$\text{or}\ \ t_1^2 + t_2^2 = \left[2\pi\sqrt{\frac{m\,(k_1 + k_2)}{k_1 k_2}}\right]^2$$

$$\text{or}\ \ t_1^2 + t_2^2 = T^2.$$

12. Answer: B

Sol:



$l \rightarrow$It is distance between point of supension and centre of gravity

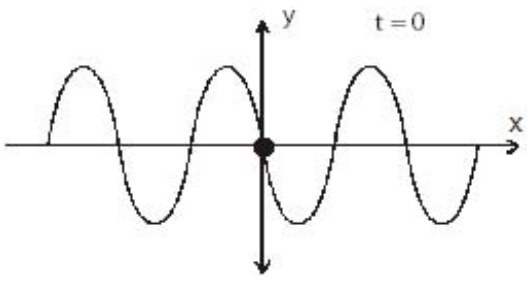
$$T = 2\pi\sqrt{\frac{I_0}{mg\ell}}$$

m$\rightarrow$mass

$I_0 \rightarrow$moment of inertia about O.

13. Answer: C

Sol:



$y = A \sin(kx - \omega t + \varphi)$

at x = 0, t = 0, y = 0 and slope is negative

$\Rightarrow \varphi = \pi$

14. Answer: D

Sol:

Heat required

$$Q_1 = ms\,\Delta T$$

Heat required Q = mL

(Power) time) = total heat required

$$ms\,\Delta T + mL = \frac{V^2}{R} \times t$$

$1 \times 4200 \times (100 - 20) + 1 \times 2260 \times 10^3 = \frac{(200)^2}{20} \times t$

$4200 \times 80 + 2266 \times 10^3 = \left(\frac{200 \times 200}{20}\right) \times t$

t = 1298 s

$= \frac{1298}{60}$ min

= 21.6 min

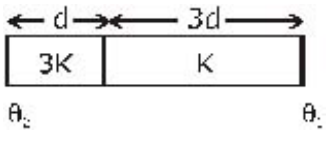
= 22 min

15. Answer: B

Sol:

Let the temperature of interface be 'θ'

$i_1 = i_2$ {steady state conduction]



$$\frac{3\,\mathrm{KA}\,(\theta_2-\theta)}{\mathrm{d}} = \frac{\mathrm{KA}\,(\theta-\theta_1)}{3\mathrm{d}}$$

$$\Rightarrow 9\theta_2 - 9\theta = \theta - \theta_1$$

$$\theta = \frac{9\theta_2}{10} + \frac{\theta_1}{10}$$

16. Answer: C

Sol:

The normal boiling point is the temperature in which the vapor pressure of a liquid becomes equal to atmospheric pressure. If the inter molecular forces are small, the liquid has a high vapor pressure. More heat will be required to separate the molecules, so the boiling point will be higher.

Therefore, the correct answer is (C)

17. Answer: A

Sol:

T.I.R only occurs when a ray moves from denser to rarer & incident angle is greater than critical angle.

Therefore, the correct answer is (A)

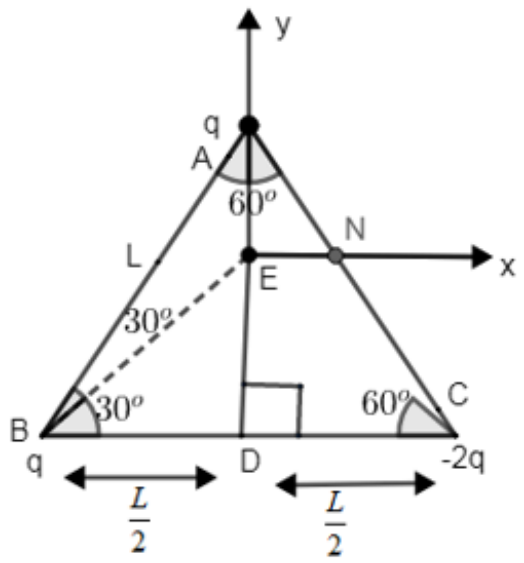
18. Answer: D

Sol:

Velocity of light depends on Refractive index of the medium and independent of Intensity and Source of light.

19. Answer: B

Sol:



Now from the above figure, in ΔBED

$\cos\ 30^\circ = \frac{BD}{BE}$

$BD = \frac{L}{\sqrt{3}}$ ..... (1)

$BE = r = \frac{2L}{\sqrt{3}}$ ..... (2)

$E_{net} = (E_A)_z + (E_B)_z + (E_C)_z$

$E_{net} = \frac{3Kq}{4L^2} + \frac{3Kq}{4L^2} + \frac{3K(-2)q}{4L^2}$

$E_{net} = 0$

Hence electric field in the z-direction will be zero.

20. Answer: D

Sol:

Density is same

$M = \frac{4}{3}\pi R^3\rho,\ \text{and}\ 2M = \frac{4}{3}\pi R'^3\rho$

$R' = 2^{1/3}R$

$W = \frac{GMm}{R^2}$

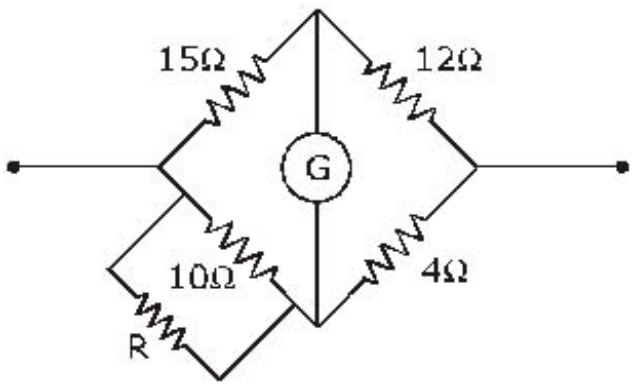
$W_2 = \frac{G2Mm}{R'^2}$

$W_2 = 2^{1/3}\ W$

Physics - Section B

21. Answer: 10

Sol:



For a balanced wheat stone bridge

$\frac{15}{\frac{10R}{10+R}} = \frac{12}{4}$

$\frac{10R}{10+R} \times 12 = 15 \times 4$

$\frac{120R}{10+R} = 60$

$600 + 60R = 120R$

$120R - 60R = 600$

$60R = 600$

$R = \frac{600}{60}$

$R = 10\ \Omega$

22. Answer: 25

Sol:

$\frac{\Delta M}{M} = \frac{\Delta \mu}{\mu} = \frac{250}{500} = \frac{1}{2}$

$\frac{1}{2} = \frac{x}{499} \Rightarrow \simeq 250$

23. Answer: 27

Sol:

$R = R_0 A^{1/3}$

$4.8 = R_0 (64)^{1/3}$

$4.8 = R_0 4$ ...(i)

$4 = R_0\ (A)^{1/3}$ ...(ii)

(i) divided (ii)

$1.2 = \frac{4}{(A)^{1/3}}$

$A = \frac{64}{1.728} = \frac{1000}{x}$

$x = \frac{1728}{64} = 27$

24. Answer: 41

Sol:

$\because$ cut-off wavelength for continuous x-ray is given as : $\lambda_{\min}=\frac{\mathrm{hc}}{\mathrm{eV}_0}$

$\therefore \frac{\mathrm{hc}}{\mathrm{eV}_0}=\lambda \& \frac{\mathrm{hc}}{3\,\mathrm{eV}_0}=\lambda-\Delta\lambda$

$\left(\mathrm{V}_0=\right.$ accelerating voltage $)$

$\Rightarrow \mathrm{V}_0=\frac{2\,\mathrm{hc}}{3\mathrm{e}\Delta\lambda}=41\ \mathrm{kV}$

25. Answer: 6.25

Sol:

Given, mass of bullet $(\mathrm{m})=10\ \mathrm{g}=0.01\ \mathrm{kg}$

Speed of bullet $(\mathrm{v})=500\ \mathrm{m\ s^{-1}}$

Width of the door $(1)=1.0\ \mathrm{m}$

Mass of the door $(\mathrm{M})=12\ \mathrm{kg}$

As bullet gets embedded exactly at the centre of the door, therefore its distance from the hinged end of the door,

$(\mathrm{r})=\frac{1}{2}=\frac{1}{2}\ \mathrm{m}$

Angular momentum transferred by the bullet to the door,

$(\mathrm{L})=\mathrm{mv}\times\mathrm{r}$

$=0.01\times500\times\frac{1}{2}$

$=2.5\ \mathrm{J}-\mathrm{s}$

Moment of inertia of the door about the vertical axis at one of its end,

$\left(\mathrm{I}\right)=\frac{\mathrm{Ml}^2}{3}=\frac{12\times(1)^2}{3}=4\ \mathrm{kg}-\mathrm{m}^2$

But angular momentum, $(\mathrm{L})=\mathrm{I}\omega$

$\therefore\ \ 2.5=4\times\omega$

or $\omega=\frac{2.5}{4}$

$\omega=0.625\,\mathrm{rads}^{-1}$

Chemistry - Section A

1. Answer: D

Sol:

First write electronic configuration of that element/ion check for an any unpaired electrons present. The energy required for removal of that electron will be less as compared to the energy required to remove an electron from an electron pair.

Also, compare the energies of the orbitals occupying those electrons. It will be easier to remove an electron from an orbital that is lower in energy than the one with higher in energy. First ionization enthalpy generally decreases across the period

Electronic configuration :

La =[Xe] $4f^0$ $5d^1$ $6s^2$; La^{3+} = [Xe]

Gd =[Xe] $4f^7$ $5d^1$ $6s^2$; Gd^{3+} = [Xe] $4f^7$

Lu =[Xe] $4f^{14}$ $5d^1$ $6s^2$; Lu^{3+} = [Xe] $4f^{14}$

Sm =[Xe] $4f^6$ $6s^2$; Sm^{3+} = [Xe] $4f^5$

Fourth ionization enthalpy corresponds to the removal of the fourth electron. It will be difficult to remove an electron from an ion having noble gas configuration. Hence, La will have the highest fourth ionization enthalpy (that is, it be most difficult to form La^{4+}) ion as compared to Gd^{4+} and Lu^{4+}.

2. Answer: A

Sol:

(A) It is a general test for the detection of halogens, nitrogen and sulphur in an organic compound. These elements are covalently bonded to the organic compounds. In order to detect them, these have to be converted into their ionic forms. This is done by fusing the organic compound with sodium metal.

(B) Carbon and hydrogen are detected by heating the organic compound with cupric oxide (CuO) strongly, where carbon is oxidized to carbon dioxide and hydrogen to water.

(C) Silver nitrate test is a popular test that is used to detect the type of halogen that could be present in a haloalkane.

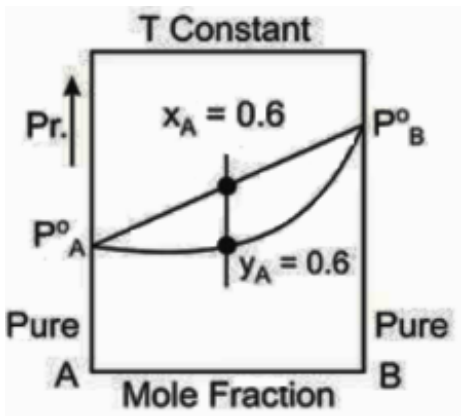
(D) The sodium fusion extract is acidified with acetic acid and lead acetate is added to it. A black precipitate of lead(II) sulfide indicates the presence of sulfur.

(a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

3. Answer: C

Sol:

$P_A^\circ = 500 \text{ torr}; \; P_B^\circ = 800 \text{ torr}$



Let, mole fracion of A in vapour = y_A; mole fracion of B in vapour = y_B

When most of the liquid has vapourized y_A would be, 0.6 since x_A is 0.6 (Given)

$$y_A = \frac{P_A^o x_A}{P_A^o x_A + P_B^o (1 - x_A)}$$

$$\Rightarrow 0.6 = \frac{500 \cdot x_A}{500 x_A + 800 (1 - x_A)}$$

$$x_A = 0.70; \; x_B = 0.30$$

4. Answer: D

Sol:

The thermal stability of oxides of group 16 elements increasesas we move down the group due to increaes in the atomic mass of the elements.

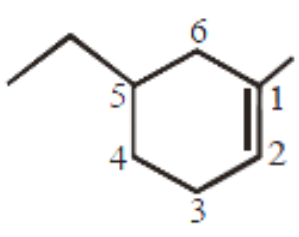
So the thermal stability of oxides of group 16 elements increases in order.

$SO_2 < SeO_2 < TeO_2 < PoO_2$

Hence option D is correct.

5. Answer: B

Sol:



6. Answer: A

Sol:

$$h = 0.03 \; ; \;\; C = 0 \; .1 \text{ M}$$

$$K_h = Ch^2 = 9 \times 10^{-5}$$

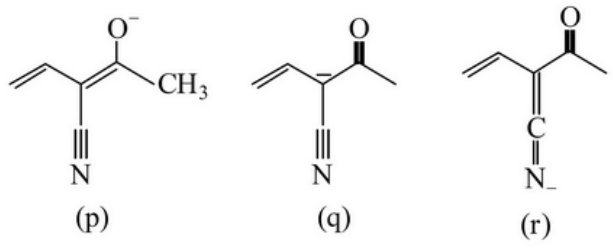
$$K_h = \frac{K_w}{K_a} = 9 \times 10^{-5}$$

$$\Rightarrow K_a = \frac{10^{-14}}{9 \times 10^{-5}}$$

$$= 1.11 \times 10^{-10} \approx 1 \times 10^{-10}$$

7. **Answer:** D

Sol:



E.N. (O > N > C)

$\Rightarrow$ – ve charge at more E.N.

Stabilized R.S.

$\Rightarrow$ p > r > q

8. **Answer:** A

Sol:

(A) As the difference in electronegativities of bonded halogen atoms increases, stability increases. Stability of interhalogen compounds increases with an increase in electro-negativity difference between halogens.

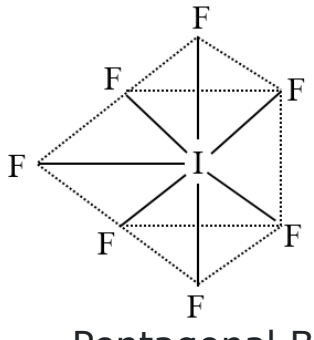
So, the order is IF > BrF > ClF.

(B) Hydrolysis of IF_7 :

$$IF_7 + 6H_2O \rightarrow 7HF + H_5IO_6$$

(C)The main aim of formation of interhalogen compounds is stability.They are fully paired due to which diamagnetic in nature due to pairing of all bonds.

(D) $IF_7 \rightarrow$



Pentagonal Bipyramidal

9. **Answer:** B

Sol:

$CrO_3(aq) + 6H^+(aq) + 6e \rightarrow Cr(s) + 3H_2O$

$n = 6$

Atomic weight of $Cr = 52$

Q = i $\times$ t = 24000C

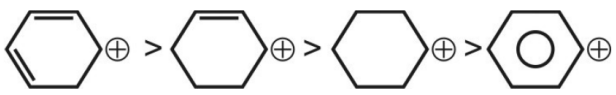
$$W = \frac{\text{Atomic Weight}}{n_f \times 96500} \times i \times t$$

$$= \frac{52}{6 \times 96500} \times 24000 = 2.155g$$

$\therefore 2.15g$ of chromium will be plated out by 24000C.

10. Answer: C

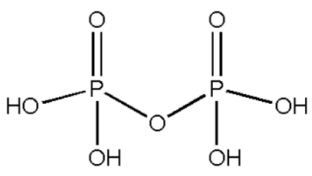
Sol:



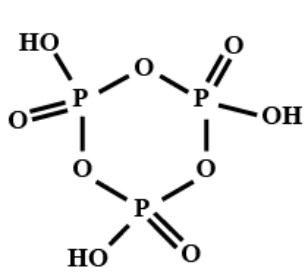
ease of S_N1 and hence the correct order is $\propto$ stability of carbocation intermediate
I > IV > III > II

11. Answer: A

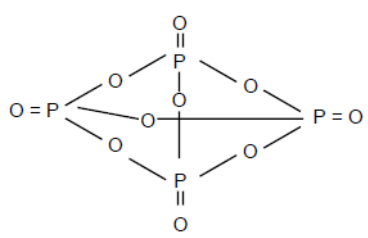
Sol:



Pyrophosphoric acid



Cyclotrimeta-
phosphoric acid



Dimer of
phosphorus
pentaoxide

Number of P-O-P bond	
Pyrophosphoric acid	1
Cyclotrimetaphosphoric acid	3
Dimer of phosphorus pentaoxide	6

12. Answer: A

Sol:

$\because n = 1,\ t_{\frac{1}{2}} = \frac{0.693}{K}$

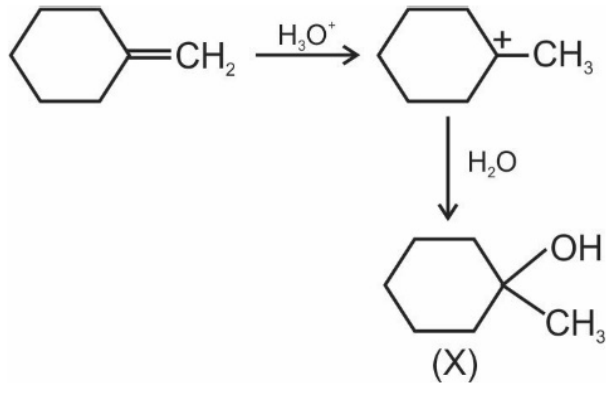
$t_{av.} = 1.44\ t_{\frac{1}{2}}$

$t_{75\%} = 2t_{\frac{1}{2}}$

So, $t_{\frac{1}{2}} < t_{av.} < t_{75\%}$

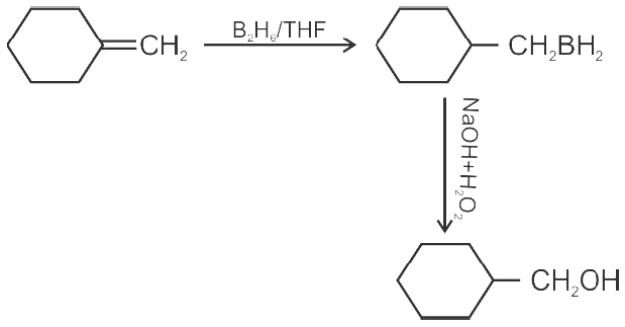
13. Answer: D

Sol:



H_2O is added according to Markonvikov's rule

and



H_2O is added according to Anti Markovnikov's rule

14. Answer: C

Sol:

(i) In Cl_2, chlorine atomic size is smaller than NaCl, because in Cl_2, chlorine held by covalent bond while in NaCl, Cl is held by ionic bond. So, the atomic radius of Cl in NaCl is greater than Cl in Cl_2.

(ii) As we know, down the group mass of an element increase as compare to volume. So, density increases.

(iii) Intermolecular interactions in a molecular solid are relatively weak as compared with covalent solid.

Molecular solid tends to be soft and low melting point.

(iv) By slater's Rule, z_{eff}

B, C, N, O, F

$Z_{eff} = Z - \sigma$, Here Z = atomic no. & $\sigma \rightarrow$ screening constant.

For s or p-orbital	n 0.35	(n–1) 0.85	(n-2), (n–3) etc. 1.00
For d or f-orbital	0.35	1.00	1.00

Electronic configuration

$_5B \rightarrow \underset{n-1}{(1s^2)} \left(\underset{n}{2s^2\, 2p^1} \right)$, Z_{eff} for P e^-

σ= 2×0.35 + 2×0.85 = 2.4

$(Z_{eff})_B$ = 5–2.4 = 2.6

$_6C \rightarrow \left(1s^2\right) \left(2s^2\, 2p^2\right)$, Z_{eff} for P e^-

σ = 3×0.35 + 2×0.85 = 2.75

$(Z_{eff})_C$ = 6–2.75 = +3.25

$_7N \rightarrow 1s^2\ 2s^2\, 2p^3$, Z_{eff} for P e^-

σ = 4×0.35 + 2×0.85 = 3.1

$(Z_{eff})_N$ = 7–3.1 = + 3.9

So, we can see zeff is increase in the magnitude of 0.65.

15. Answer: D

Sol:

Let the mass of sodium salt of methyl orange = xg

given 7% of salt contain sodium, that is $\frac{7}{100} \times x = 23$

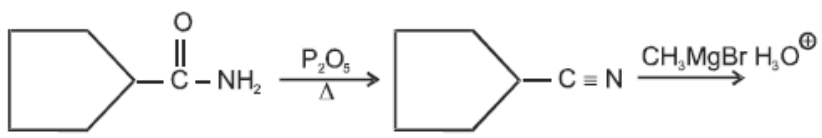
x = 328.57

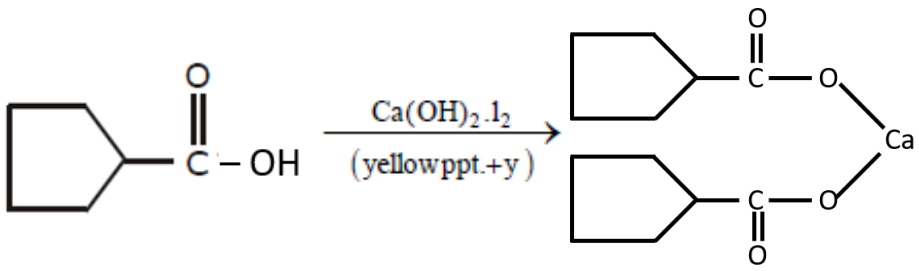
x ≈ 329g

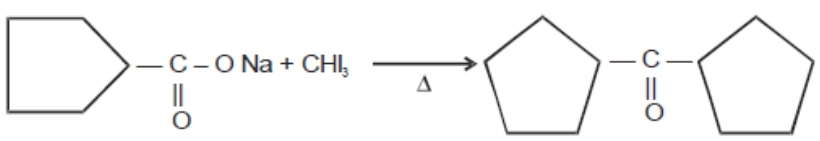
that is mass of salt = 329g

16. Answer: C

Sol:







Therefore, the correct answer is (C)

17. Answer: B

Sol:

⇒As the (A–H) bond strength (↑) acidic nature (↓)

⇒As the electronegativity (↑) A–H bond strength (↑) acidic nature (↓)

(1) HCl < HBr < HI < HF (Incorrect)

Correct order HI > HBr > HCl > HF

(2) $CH_4 < SiH_4 < GeH_4$ (correct)

As we go up to down in the group EN (↓)

∴ A–H bond strength (↓), Hence they easily donate H^+

∴ Acidic nature (↑)

(3) $NH_3 < CH_4 < H_2O < HF$ (Incorrect)

Correct order $H_2O > HF > CH_4 > NH_3$

(4) $HBr < H_2S < NH_3$ (Incorrect)

Correct order⇒$HBr < H_2S > NH_3$

18. Answer: B

Sol:

$K_{eq.}$ at 1400 K = $\frac{0.29}{1.1\times10^{-6}} = 2.6 \times 10^5$

K_{eq} at 1500 K = $\frac{1.3}{1.4\times10^{-5}}$ = 9.2×10^4

$\Rightarrow$ T ↑ k_{eq} ↓ $\Delta H < 0$ exothermic

19. Answer: A

Sol:

Total work done = area of rectangle of $5\ \text{atm}$ height and $10\ \text{L}$ width-area of half of circle

$15\left(20-10\right) - \left(\frac{\pi\times5^2}{2}\right)$

$= \left(150 - \frac{25\pi}{2}\right)$

20. Answer: B

Sol:

(a) Chlorophyll:-$C_{55}H_{72}O_5N_4Mg$

the process by which light energy is converted to chemical energy through the synthesis of organic compounds. Chlorophyll is found in virtually all photosynthetic organisms, including green plants, cyanobacteria, and algae.

(b) Blood pigment :- Iron (Fe) is a constituent of blood pigment

(c) Wilkinson catalyst: Wilkinson's catalyst is the common name for chloridotris(triphenylphosphine)rhodium(I), a coordination complex of rhodium with the formula $[RhCl(PPh_3)_3]$ (Ph = phenyl).

(d) Vitamin B_{12} which is also known as cyanocobalamine conatain cobalt.

Therefore, the correct option is (B)

Chemistry - Section B

21. Answer: 5

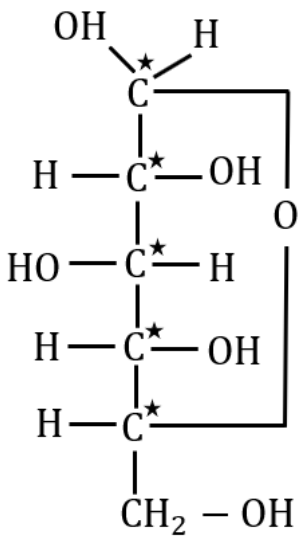
Sol:

If the mirror image of that substance or molecules is not superimposable. The substance is said to be a chiral or asymmetric molecule.

Carbon is having four different substituents attached to it.

If the carbon is found to be unsaturated then two or three bonds are formed with the same substituents.

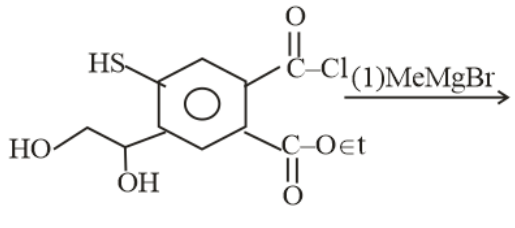
In this there are five chiral carbons are attached to Beta-D-glucopyranose.

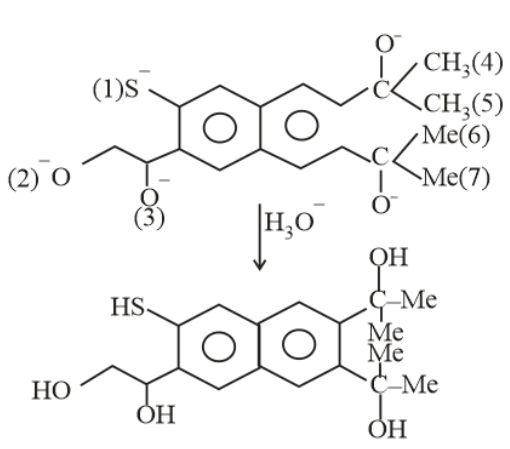


Number of chiral carbon are = 5

22. Answer: 7

Sol:





$\therefore$ 7 moles of CH_3MgBr will be required.

23. Answer: 4

Sol:

Among the triatomic molecules/ions, $BeCl_2$, N_3^-, CO_2, SO_2, BeF_2, $SnCl_2$, ICl_2^-, I_3^- and XeF_2, the total number of the linear molecule(s)/ion(s) where the hybridization of the central atom does not have a contribution from the d-orbital(s) is 4.

These include $BeCl_2$, N_3^-, CO_2, BeF_2
In the remaining molecules/ions, $SnCl_2$ is bent, SO_2 is V-shaped with sp^3 hybridization, ICl_2^-, I_3^- and XeF_2, are linear with sp^3d hybridization.

24. Answer: 23

Sol:

ΔH_f^0 = ΔH_f^0 (Products) – ΔH_f^0 (Reactants)

$= \Delta H_f^0\left(Al_2O_3\right) - 3 \times \Delta H_f^0\left(CaO\right)$

= – 1675 –3 (–635)

= 230 kJ

Answer = $\frac{230}{10} = 23$

25. Answer: 6

Sol:

$Ca_x \;\; Al_{12}S_{24}O_{72}$

$\Rightarrow 2x + 12(+3) + 24(+4) + 72(-2) = 0$

$\Rightarrow X = 6$

Continuing to keep the pledge

of **imparting education** for the **last 18 Years**

102908+
SELECTIONS SINCE 2007

JEE (Advanced)	JEE (Main)	NEET/AIIMS	NTSE/OLYMPIADS
18798	46405	32492 (Under 50000 Rank)	5213 (6th to 10th class)

Most Promising RANKS
Produced by MOTION Faculties

NEET / AIIMS

- **AIR-1 to 10** — 25 Times
- **AIR-11 to 50** — 85 Times
- **AIR-51 to 100** — 90 Times

JEE MAIN+ADVANCED

- **AIR-1 to 10** — 9 Times
- **AIR-11 to 50** — 41 Times
- **AIR-51 to 100** — 47 Times

NITIN VIIJAY (NV Sir)
Founder & CEO

Nation's Best SELECTION
Percentage (%) Ratio

Student Qualified in NEET

(2025)
6972/7645 =
91.2%

Student Qualified in JEE ADVANCED

(2025)
3231/6332 =
51.02%

Student Qualified in JEE MAIN

(2025)
6930/10532 =
65.8%