Instructions for the Candidate:

1. Each multiple choice question has only one correct answer and marks are awarded only for the correct answer. There is no negative marking on wrong answer.

2. Use BLUE OR BLACK BALL POINT PEN only for all entries and for filling the bubbles in the OMR Answer Sheet.

3. After cutting half upper part of this page, invigilator preserve it along with student’s OMR sheet.

4. English version of questions paper is to be considered as authentic and final to resolve any ambiguity.

5. Use of calculator, log table, mobile phones, any electronic gadget and slide rule etc. is strictly prohibited.

6. Candidate will be allowed to leave the examination hall at the end of examination time period only.

7. If a candidate is found in possession of books or any other printed source, he/she is liable to be disqualified. Similarly, if a candidate is found giving or obtaining (or attempting to give or obtain) assistance from any source, he/she is liable to be disqualified.

8. English version of questions paper is to be considered as authentic and final to resolve any ambiguity.

9. One blank sheet for rough work is also enclosed.

10. OMR sheet is placed within this paper and can be taken out from this paper but seal of paper must be opened only at the start of paper.
001. An 1800 W toaster, a 1.3KW electric fan and a 100W lamp are plugged in the same 120V circuit i.e. all the three devices are in parallel. What is the approximate value of the total current (i.e. sum of the current drawn by the three devices) through circuit?
(A) 27A  (B) 40A  (C) 120A  (D) 18A

002. Four very long current carrying wires in the same plane intersect to form a square 40.0cm on each side as shown in the figure. What is the magnitude of current I so that the magnetic field at the centre of the square is zero?

(A) 18A  (B) 22A  (C) 38A  (D) 2A
003. If the current in the toroidal solenoid increases uniformly from zero to 6.0A in 3.0μs. Self inductance of the toroidal solenoid is 40μH. The magnitude of self induced emf is
(A) 48V  (B) 80V  (C) 160V  (D) 24V

004. An electron is at ground state of the H atom. Minimum energy required to excite the H atom into second excited state is
(A) 3.4eV  (B) 13.6eV  (C) 12.1eV  (D) 10.2eV

005. A particle enters uniform constant magnetic field region with its initial velocity parallel to the field direction. Which of the following statements about its velocity is correct? (neglect the effects of other fields)
(A) There is change only in direction  (B) There is change in both magnitude and direction  (C) There is no change  (D) There is change only in magnitude

006. Magnetic susceptibility of diamagnetic materials is of the order of (SI units)
(A) –10⁻⁵  (B) +10⁻⁵  (C) +10⁻⁴ to +10⁻²  (D) +10⁻⁵

007. Magnitude of binding energy of satellite is E and kinetic energy is K .The ratio E/K is
(A) 1/2  (B) 2/1  (C) 1/4  (D) 1

008. Figure shows the total acceleration \( a = 32\text{m/s}^2 \) of a moving particle moving clockwise in a circle of radius R=1m. What are the centripetal acceleration and speed v of the particle at given instant?

(A) 16m/s², 4m/s  (B) 16\sqrt{3} \text{ m/s}², 4\sqrt{3} \text{ m/s}  (C) 16\sqrt{3} \text{ m/s}², 4m/s  (D) 16m/s², 16m/s
009. A force \( F = 75\text{N} \) is applied on a block of mass 5kg along the fixed smooth incline as shown in figure. Here gravitational acceleration \( g = 10\text{m/s}^2 \). The acceleration of the block is

\[
\begin{align*}
\text{(A) } & 5\frac{m}{s^2} \text{ upwards the incline} \\
\text{(B) } & 10\frac{m}{s^2} \text{ downwards the incline} \\
\text{(C) } & 10\frac{m}{s^2} \text{ upwards the incline} \\
\text{(D) } & 5\frac{m}{s^2} \text{ downwards the incline}
\end{align*}
\]

010. A 3kg object has initial velocity \( (6\mathbf{i} - 2\mathbf{j})\text{m/s} \). The total work done on the object if its velocity changes to \( (8\mathbf{i} + 4\mathbf{j})\text{m/s} \) is

\[
\begin{align*}
\text{(A) } & 120\text{J} \\
\text{(B) } & 216\text{J} \\
\text{(C) } & 44\text{J} \\
\text{(D) } & 60\text{J}
\end{align*}
\]

011. A heat engine absorbs 360J of energy by heat and performs 25J of work in each cycle. The energy expelled to the cold reservoir in each cycle is

\[
\begin{align*}
\text{(A) } & 385\text{J} \\
\text{(B) } & 335\text{J} \\
\text{(C) } & 14.4\text{J} \\
\text{(D) } & 360\text{J}
\end{align*}
\]

012. Three nonconducting large parallel plates have surface charge densities \( \sigma, -2\sigma \) and \( 4\sigma \) respectively as shown in figure. The electric field at the point \( P \) is

\[
\begin{align*}
\text{(A) } & \frac{3\sigma}{\varepsilon_0} \\
\text{(B) } & \frac{\sigma}{\varepsilon_0} \\
\text{(C) } & \frac{\sigma}{2\varepsilon_0} \\
\text{(D) } & \frac{3\sigma}{2\varepsilon_0}
\end{align*}
\]
013. A battery of constant voltage is available. How to adjust a system of three identical capacitors to get high electrostatic energy with the given battery
(A) Three in series
(B) Three in parallel
(C) Whatever may be combination, it will always have same electrostatic energy
(D) Two parallel and one in series

014. Five resistances are connected as shown in the figure. The equivalent resistance between points A and C is

(A) 30Ω  (B) 44Ω  (C) \( \frac{20}{3} \)Ω  (D) 21.2Ω

015. The frequencies of X rays, Gamma rays and visible light waves rays are a, b and c respectively, then
(A) a>b, b<c  (B) a<b, b>c  (C) a<b, b<c  (D) a>b>c

016. An equiconvex (biconvex) lens has focus length f. It is cut into three parts as shown in the figure. What is the focal length of Cut part I?
(A) 2f  (B) 3f  (C) \( \frac{f}{3} \)  (D) \( \frac{f}{2} \)
017. A cell has terminal voltage 2V in open circuit and internal resistance of the given cell is 2Ω. If 4A of current is flowing between points P and Q in the circuit and then the potential difference between P and Q is

\[
\begin{align*}
\text{P} & \quad \frac{2V}{4A} \quad 2\Omega \\
\text{Q} & \\
\end{align*}
\]

(A) 26V \quad \text{(B) 22V} \\
(C) 24V \quad \text{(D) 30V}

018. A Proton and an alpha particle both are accelerated through the same potential difference. The ratio of corresponding de-Broglie wavelengths is

(A) \(\sqrt{2}\) \quad \text{(B) } 2\sqrt{2} \\
(C) \frac{1}{2\sqrt{2}} \quad \text{(D) } 2

019. Two balls of mass m and 4m are connected by a rod of length L. The mass of the rod is small and can be treated as zero. The size of the balls can also be neglected. We also assume the centre of the rod is hinged, but the rod can rotate about its centre in the vertical plane without friction. What is the gravity induced angular acceleration of the rod when the angle between the rod and the vertical line is \(\theta\) as shown.

(A) \(\frac{g}{3L}\) \sin\(\theta\) \quad \text{(B) } \frac{5g}{6L}\sin\theta \\
(C) \frac{g}{6L}\cos\theta \quad \text{(D) } \frac{6g}{5L}\sin\theta
020. A projectile is projected with an initial velocity \((4\hat{i} + 5\hat{j})m/s\). Here \(\hat{j}\) is the unit vector directed vertically upwards and unit vector \(\hat{i}\) is in the horizontal direction. Velocity of the projectile (in m/s) just before it hits the ground is
(A) \(-4\hat{i} + 5\hat{j}\)
(B) \(4\hat{i} - 5\hat{j}\)
(C) \(-4\hat{i} - 5\hat{j}\)
(D) \(4\hat{i} + 5\hat{j}\)

021. What is the approximate percentage error in the measurement of time period of a simple pendulum if maximum errors in the measurement of length \(l\) and gravitational acceleration \(g\) are 3% and 7% respectively?
(A) 3 %
(B) 5 %
(C) 10 %
(D) 2 %

022. A gas undergoes the cyclic process shown in figure. The cycle is repeated 100 times per minute. The power generated is
(A) 120W
(B) 240W
(C) 100W
(D) 60W
023. Three charges lie on the frictionless horizontal surface at the vertices of equilateral triangle as shown in figure. Two charges X and Y are fixed whereas third charge Z is released. Which path will charge Z take upon release?

(A) Path – II  (B) Path – III  
(C) Path – IV  (D) Path – I

024. There are two waves having wavelengths 100cm and 101cm and same velocity 303m/s. The beat frequency is

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

025. Two polaroids A and B are placed with their polaroid axes 30° to each other as shown in the figure. A plane polarized light passes through the polaroid A and after passing through it, intensity of light becomes I_0. What is the intensity of finally transmitted light after passing through the polaroid B?

(A) 0.5I_0  (B) 0.75I_0  
(C) 0.866I_0  (D) 0.25I_0
026. Laser light has following property:
(A) laser light is highly coherent
(B) laser light always lies in X-rays region
(C) laser light does not have directionality property
(D) laser light is white light

027. A particle is moving in translatory motion. If momentum of the particle decreases by 10%, kinetic energy will decrease by:
(A) 19%  (B) 10%  (C) 5%  (D) 20%

028. Which of the statement is incorrect about the simple microscope?
(A) A convex lens of microscope with shorter focal length yields higher magnification.
(B) Biology students use to see the slides.
(C) It is not used for magnification of an object at far away from the observer.
(D) Magnification of microscope is inversely proportional to the least distance of distinct vision.

029. Surface tension of the liquid is \( S \). Work done in increasing the radius of soap bubble from \( R \) to \( 3R \) at given temperature will be
(A) \( 16\pi SR^2 \)  (B) \( 64\pi SR^2 \)
(C) \( \frac{18\pi SR^2}{3} \)  (D) \( 8\pi SR^2 \)

030. Suppose you drive to Delhi (200 km away) at 400 km/hr and return at 200 km/hr. What is yours average speed for the entire trip?
(A) 300 Km/hr  (B) Less than 300 Km/hr  (C) More than 300 Km/hr  (D) Zero
031. A system undergoes a reversible adiabatic process. The entropy of the system
(A) decreases
(B) remains constant
(C) may increase or may decrease
(D) increases

032. For the combination of gates shown here, which of the following truth table part is not true

```
A B C
--- --- ---
1 0 1 (A)
0 1 1 (B)
0 0 0 (C)
1 1 1 (D)
```

033. A narrow white light beam fails to converge at a point after going through a converging lens. This defect is known as
(A) spherical aberration
(B) chromatic aberration
(C) diffraction
(D) polarization

034. A small bead of mass M slides on a smooth wire that is bent in a circle of radius R. It is released at the top of the circular part of the wire (point A in the figure) with a negligibly small velocity. Find the height H where the bead will reverse direction.

```
A
\[ R \]
\[ H \]
```

```
(A) \( \frac{5R}{2} \)
(B) \( R \)
(C) \( 2R \)
(D) \( \frac{3R}{2} \)```

031. एक निकाय एक उत्क्रमणीय स्ट्रोम प्रक्रम से गुजरता है। निकाय की एंट्रोपी (entropy)
(A) घटती
(B) अन्धर रहती है
(C) बढ़ या घट सकती है
(D) बढ़ती

032. नीचे दिए गए तरक्के के संयोजन के लिए निम्न सत्य सारणी का कौन सा भाग सत्य नहीं है?

```
A B C
--- --- ---
1 0 1 (A)
0 1 1 (B)
0 0 0 (C)
1 1 1 (D)
```

033. एक क्षेत्र प्रकाश संकीर्ण किरण एक अभिसारी लेंस से गुजरने के पद्धति एक ही बिंदु पर अभिसारित होने में असफल होती है यह दोष निम्न कहलाता है?
(A) गोलीबाँध
(B) वर्णबाँध
(C) विवर्तन
(D) धुंधल

034. एक M द्रव्यमान का छोटा मंडल एक चिनके तार पर फिसलता है। यहाँ तार एक R त्रिज्या के चुने के भाग के रूप में मुड़ा हुआ है। मंडल को बृहत भाग के शिखर (चित्र में बिंदु A) से नाग्न वेंग से मुक्त किया जाता है। यह ऊँचाई H ज़म्म करो जहाँ मंडल अपनी दिशा पलटता है।

```
A
\[ R \]
\[ H \]
```

```
(A) \( \frac{5R}{2} \)
(B) \( R \)
(C) \( 2R \)
(D) \( \frac{3R}{2} \)```
035. Two persons A and B start from the same location and walked around a square in opposite directions with constant speeds. The square has side 60m. Speeds of A and B are 4m/s and 2m/s respectively. When will they meet first time?
(A) 20 sec  (B) 30 sec  (C) 40 sec  (D) 10 sec

036. A tire of radius R rolls on a flat surface with angular velocity ω and velocity v as shown in the diagram. If v > ωR, in which direction does friction from the tire act on the road?
(A) Towards the right  (B) Towards downwards  (C) Towards upwards  (D) Towards the left

037. Consider one dimensional motion of a particle of mass m. It has potential energy \( U = a + bx^2 \) where a and b are positive constants. At origin \( (x = 0) \) it has initial velocity \( v_0 \). It performs simple harmonic oscillations. The frequency of the simple harmonic motion depends on
(A) b and a alone  (B) b and m alone  (C) b, a and m alone  (D) b alone

038. The postulate on which the photoelectric equation is derived is
(A) electrons are associated with wave of wavelength \( \lambda = \frac{h}{p} \) where p is momentum.
(B) light is emitted only when electrons jump between orbits.
(C) light is absorbed in quanta of energy \( E = h\nu \)
(D) electrons are restricted to orbits of angular momentum \( n\frac{h}{2\pi} \) where n is an integer.

035. दो व्यक्ति A तथा B एक ही जगह से एक वर्ग पर बिपरीत दिशाओं में अच्छे चालों से चलना प्रारम्भ करते हैं। वर्ग की भुजा 60m है, A तथा B की चाल क्रमशः 4m/s तथा 2m/s है। वे पहली बार कब मिलेंगे?
(A) 20 sec  (B) 30 sec  (C) 40 sec  (D) 10 sec

036. एक R विष्या का पहिचा समतल सतह पर कोणीय वेग \( \omega \) तथा वेग \( v \) से चित्रणुसार लुढ़क रहा है। यदि \( v > \omega R \) तो टायर द्वारा सड़क पर घर्षण किस दिशा में लगेगा?
(A) दायी तरफ  (B) नीचे की तरफ  (C) ऊपर की तरफ  (D) बायी तरफ

037. एक \( m \) द्रव्यमान के कण की एक विभाज गति पर विचार कीजिए। इसकी स्थितिजोर \( U = a + bx^2 \) है जहाँ \( a \) तथा \( b \) धनात्मक नियतांक हैं। मूल बिन्दु \( (x = 0) \) पर इसका प्रारम्भिक वेग \( v_0 \) है। यह सरल आवृत्ति गति करता है जिसकी आवृत्ति निम्न पर निर्भर करती है
(A) केवल \( b \) तथा \( a \) पर  (B) केवल \( b \) तथा \( m \) पर  (C) केवल \( b, a \) तथा \( m \) पर  (D) केवल \( b \) पर

038. प्राकाश बिछुत समीकरण निम्न में से जिस अभिव्वधित (कल्पना) पर लघुचर की गई है वह है:
(A) इलेक्ट्रॉन से संबंध तरंग की तरंगदैर्घ्य \( \lambda = \frac{h}{p} \) है जहाँ \( p \) संवेग है।
(B) प्राकाश तभी उत्पन्न होता है जब इलेक्ट्रॉन एक कक्ष से दूसरे में कुदरता है।
(C) प्राकाश का अवशेषण ऊर्जा के क्वांटा \( E = h\nu \) के रूप में होता है।
(D) इलेक्ट्रॉन केवल उन्हीं कक्षों में रह सकते हैं जिन्में कोणीय संवेग \( n\frac{h}{2\pi} \) हो तथा \( n \) एक पूर्णांक है।
039. A layer of oil with density 724 kg/m$^3$ floats on water of density 1000 kg/m$^3$. A block floats at the oil-water interface with 1/6 of its volume in oil and 5/6 of its volume in water, as shown in the figure. What is the density of the block?

(A) 954 kg/m$^3$  (B) 1024 kg/m$^3$
(C) 1276 kg/m$^3$  (D) 776 kg/m$^3$

040. A string fixed at both ends has a standing wave mode for which the distances between adjacent nodes is 18cm. For the next consecutive standing wave mode distances between adjacent nodes is 16cm. The minimum possible length of the string is

(A) 72 cm  (B) 144 cm
(C) 204 cm  (D) 288 cm

041. A wire loop that encloses an area of 20cm$^2$ has a resistance of 10Ω. The loop is placed in a magnetic field of 2.4T with its plane perpendicular to the field .The loop is suddenly removed from the field. How much charge flows past a given point in the wire?

(A) $2.4 \times 10^{-3}$ C  (B) $1.2 \times 10^{-4}$ C
(C) $10^{-1}$ C  (D) $4.8 \times 10^{-4}$ C

042. A right isosceles triangle of side $a$ has charges $+q$, $+3q$ and $-q$ arranged on its vertices as shown in the figure. What is the electric potential at point P midway between the line connecting the $+q$ and $-q$ charges?

\[
\frac{3q}{2\sqrt{2} \pi \varepsilon_a} \quad \frac{3q}{\pi \varepsilon_a} \quad \frac{3q}{\sqrt{2} \pi \varepsilon_a} \quad \frac{q}{\pi \varepsilon a}
\]
043. Shown below is a graph of current versus applied voltage for a diode. Approximately what is the resistance of the diode for an applied voltage of −1.5V?

Current(A)

<table>
<thead>
<tr>
<th>Voltage(V)</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current(A)</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

(A) 1Ω  (B) 2Ω  (C) ∞  (D) Zero

044. A sound wave is generated by the howl of a wolf in the night. How would we describe the motion of a particular air molecule near the ground, a mile away from the wolf, on average (i.e. ignoring the random wandering of gas molecules)?

(A) It moves away from the wolf at the speed of sound
(B) It moves back and forth (oscillating) towards the wolf
(C) It moves in the horizontal circle.
(D) It moves up and down in an oscillating fashion

045. Which of the following Material has lowest resistivity?

(A) Silver  (B) Manganin
(C) Copper  (D) Constantan

046. An incompressible non viscous fluid flows steadily through a cylindrical pipe which has radius 2R at point A and radius R at point B farther along the flow direction. If the velocity of the fluid at point A is V, its velocity at the point B will be

(A) V  (B) V/2
(C) 4V  (D) 2V

047. In a room where the temperature is 30°C a body cools from 61°C to 59°C in 4 minutes. The time taken by the body to cool from 51°C to 49°C will be about

(A) 6 minutes  (B) 5 minutes
(C) 8 minutes  (D) 4 minutes
048. A student’s 9.0 V, 7.5W portable radio was left on from 9:00 P.M. until 3:00 A.M. How much charge passed through the wires?
(A) 12000C  (B) 18000C  
(C) 24000C  (D) 6000C

049. A conducting wheel rim in which there are three conducting rods of each of length \( l \) is rotating with constant angular velocity \( \omega \) in a uniform magnetic field \( B \) as shown in figure. The induced potential difference between its centre and rim will be
\[ (A) \frac{B ol^2}{2} \quad (B) B \omega l^2 \]
\[ (C) \frac{3}{2}B \omega l^2 \quad (D) 0 \]

050. An imaginary, closed spherical surface \( S \) of radius \( R \) is centered on the origin. A positive charge \( +q \) is originally at the origin and electric flux through the surface is \( \Phi_E \). Three additional charges are now added along the x axis: \(-3q\) at \( x=-\frac{R}{2} \), \(+5q\) at \( x=\frac{R}{2} \) and \( 4q \) at \( x=\frac{3R}{2} \). The flux through \( S \) is now
\[ (A) 4\Phi_E \quad (B) 6\Phi_E \]
\[ (C) 7\Phi_E \quad (D) 3\Phi_E \]
051. Which of the following reacts fastest with conc. HCl?

(A) \(\text{CH}_3\text{CHOH} - \text{CH}_3\)
(B) \((\text{CH}_3)_3\text{COH}\)
(C) \(\text{CH}_2 = \text{CH} - \text{CH}_2\text{OH}\)
(D) \(\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}\)

052. A polymer which is commonly used as a packaging material is

(A) Polypropylene (B) PVC
(C) Bakelite. (D) Polythene

053. Which pair does not represent the cyclic compound of the molecular formula \(\text{C}_4\text{H}_6\)?

(A) \(\text{C}_4\text{H}_6\)
(B) \(\text{C}_4\text{H}_6\)
(C) \(\text{C}_4\text{H}_6\)
(D) \(\text{C}_4\text{H}_6\)

054. Product P in the above reaction is:

(A) \(\text{O=C-CH}_3\)
(B) \(\text{CHO}\)
(C) \(\text{COOH}\)
(D) \(\text{OH-CH-CH}_3\)
055. The structure of carboxylate ion is best represented as:
(A) \( \text{O}^- \text{C}^- \text{O}^- \)  (B) \( \text{O}^- \text{C}^- \text{O}^- \)  
(C) \( \text{O}^- \text{C}^- \text{O}^- \)  (D) \( \text{O}^- \text{C}^- \text{O}^- \) 

056. Which one of the following is not a unit of energy?
(A) kg. m s\(^{-2}\)  (B) lit-atm  
(C) kg m\(^2\) s\(^{-2}\)  (D) Nm

057. When a liquid that is immiscible with water was steam distilled at 95.2°C at a total pressure of 99.652KPa. The distillate contained 1.27gm of the liquid per gram of water. What will be the molar mass of the liquid if the vapour pressure of water is 85.140KPa at 95.2°C ?
(A) 105.74 gm mol\(^{-1}\)  (B) 99.65 gm mol\(^{-1}\)  
(C) 18 gm mol\(^{-1}\)  (D) 134.1 gm mol\(^{-1}\)

058. When a liquid that is immiscible with water was steam distilled at 95.2°C at a total pressure of 99.652KPa. The distillate contained 1.27gm of the liquid per gram of water. What will be the molar mass of the liquid if the vapour pressure of water is 85.140KPa at 95.2°C ?
(A) 105.74 gm mol\(^{-1}\)  (B) 99.65 gm mol\(^{-1}\)  
(C) 18 gm mol\(^{-1}\)  (D) 134.1 gm mol\(^{-1}\)

059. What will happen if a cell is placed into 0.4% (mass/volume) NaCl solution
(A) Cell will shrink  (B) there will be no change in cell volume  
(C) Cell will dissolve  (D) Cell will swell

060. What will happen if a cell is placed into 0.4% (mass/volume) NaCl solution
(A) Cell will shrink  (B) there will be no change in cell volume  
(C) Cell will dissolve  (D) Cell will swell

061. If a compound is formed by X, Y and Z atoms and Z is present on the corners, Y is present \( \frac{1}{2} \) tetrahedral voids and X atom in \( \frac{1}{2} \) octahedral voids, which of the following will be the molecular formula of the compound.
(A) \( X_2YZ \)  (B) \( X_2Y_4Z \)  
(C) \( XYZ_4 \)  (D) \( XYZ \)
062. If an element A is placed in electrochemicals series above element B but below element C, then the order of oxidation power of elements
(A) C > B > A  (B) C > A > B  
(C) B > A > C  (D) A > B > C

063. What will be the decreasing order of stability of following carbocations?
(A) 1 > 2 > 3 > 5 > 4  
(B) 5 > 4 > 3 > 2 > 1  
(C) 1 > 2 > 3 > 4 > 5  
(D) 3 > 5 > 4 > 1 > 2

064. In above reaction P and Q are
(A)  
(B)  
(C)  
(D)  

062. यदि तत्व A विभिन्न रासायनिक श्रेणी में तत्व B से ऊपर है लेकिन तत्व C से नीचे उपस्थित है, तत्वों की आक्सीडेंस क्रम का क्रम क्या होगा?
(A) C > B > A  (B) C > A > B  
(C) B > A > C  (D) A > B > C

063. निम्न कार्बोजम्पायनों के स्थायित्व का घटता हुआ क्रम होगा
(A) 1 > 2 > 3 > 5 > 4  
(B) 5 > 4 > 3 > 2 > 1  
(C) 1 > 2 > 3 > 4 > 5  
(D) 3 > 5 > 4 > 1 > 2

064. उपरोक्त अभिक्रिया में P तथा Q है
(A)  
(B)  
(C)  
(D)  

1-AB | [ 17 ] | PTO
065. The one electron species having ionization energy of 54.4 eVs
(A) Be$^{+3}$  (B) He$^{+}$  
(C) H $^+$  (D) Be$^{+2}$

066. Which of the following set of quantum numbers represents the highest energy of an atom?
(A) $n = 3, l = 1, m = 1, s = +\frac{1}{2}$  
(B) $n = 3, l = 2, m = 1, s = +\frac{1}{2}$  
(C) $n = 4, l = 0, m = 0, s = -\frac{1}{2}$  
(D) $n = 3, l = 0, m = 4, s = +\frac{1}{2}$

067. In OF$_2$, oxygen has hybridization of
(A) sp$^2$  (B) sp$^3$  
(C) None of the options  (D) sp

068. Amongst NO$_3^-$, AsO$_3^{3-}$, CO$_3^{2-}$, ClO$_3^-$, SO$_3^{2-}$, and BO$_3^{3-}$ the non-planar species are
(A) AsO$_3^{3-}$, CO$_3^{2-}$ and SO$_3^{2-}$  
(B) NO$_3^-$, CO$_3^{2-}$ and BO$_3^{3-}$  
(C) SO$_3^{2-}$, ClO$_3^-$ and BO$_3^{3-}$  
(D) CO$_3^{2-}$, SO$_3^{2-}$ and BO$_3^{3-}$

069. The Lewis acidity of BF$_3$ is less than BCl$_3$ even though fluorine is more electronegative than chlorine. It is due to
(A) stronger 2p(B)$\rightarrow$2p(F) $\pi$ - bonding  
(B) stronger 1p(B)$\rightarrow$3p (Cl) $\sigma$ - bonding  
(C) stronger 2p(B)$\rightarrow$3p(Cl) $\pi$ - bonding  
(D) stronger 2p(B)$\rightarrow$2p (F) $\sigma$ - bonding

070. The IUPAC name of the compound is:

\[
\text{CONH}_2 \quad \text{CHO}
\]
(A) 6-keto-2-methyl hexamide  
(B) 2-carbamoylhexanal  
(C) 2-carbamoylhex-3-enal  
(D) 2-methyl-6-oxohex-3-enamide
071. The IUPAC name of
\[
\begin{array}{c}
\text{F} \\
\text{I} \\
\text{Cl} \\
\text{Br}
\end{array}
\]
is
(A) 2-Bromo-1-chloro-5-fluoro-3-iodo benzene  
(B) 4-Bromo-2-chloro-5-iodo-1-fluoro benzene  
(C) 2-carbamoylhex-3-enal  
(D) 1-Bromo-2-chloro-3-fluoro-6-iodo benzene

072. Which of the following compounds contain at least one secondary alcohol?

\[
\begin{array}{cc}
(i) & \text{OH} \\
(ii) & \text{OH} \\
(iii) & \text{CH}_3\text{OH} \\
(iv) & \text{OH} \\
(v) & \text{OH} \\
(vi) & \text{OH}
\end{array}
\]
(A) (i), (ii), (iii)  
(B) (i), (ii), (iii), (v)  
(C) (i), (iii), (v)  
(D) (i), (ii), (iv), (vi)

073. Transition state 2 (T.S.2) is structurally most likely as:

\[
\begin{array}{c}
\text{E} \\
\text{T.S.1} \\
\text{Intermediete1} \\
\text{T.S.2} \\
\text{T.S.3} \\
\text{reactant} \\
\text{Product}
\end{array}
\]
(A) transition state 3 (T.S.3)  
(B) intermediate 2  
(C) product  
(D) intermediate 1
074. The decreasing order of electron affinity is:
(A) Cl > F > Br > I
(B) I > Br > Cl > F
(C) Br > Cl > F > I
(D) F > Cl > Br > I

075. The isomerism exhibited by following compounds \([\text{Co(NH}_3)_6][\text{Cr(CN)}_6]\) and \([\text{Cr(NH}_3)_6][\text{Cr(CN)}_6]\) is
(A) Coordination isomerism
(B) Ionization isomerization
(C) Polymerisation isomerism
(D) Linkage isomerism

076. For the reaction
\[ 2\text{SO}_2 + \text{O}_2 (\text{excess}) \rightarrow 2\text{SO}_3 \]
the order of reaction with respect to \(\text{O}_2\) is
(A) one (B) two (C) three (D) zero

077. Friedel – Craft reaction is not related with:
(A) Nitration (B) Acylation (C) Reduction (D) Sulphonation

078. Compound \(\begin{align*}
\text{Cl} & \quad \text{C} = \text{C} \\
\text{H} & \quad \text{C}_2\text{H}_5
\end{align*}\) has the following prefix
(A) Z (B) trans (C) Anti (D) E

079. The molecule \(\text{C}_3\text{O}_2\) has a linear structure. This compound has
(A) 3 \(\sigma\) and 2 \(\pi\) bonds
(B) 2 \(\sigma\) and 3 \(\pi\) bonds
(C) 3 \(\sigma\) and 4 \(\pi\) bonds
(D) 4 \(\sigma\) and 4 \(\pi\) bonds

080. The structure of XeF\(_2\) and NH\(_3\) respectively are
(A) linear, pyramidal
(B) linear, see-saw
(C) bent, see-saw
(D) bent, tetrahedral
081. The number of lone pair(s) of electrons on the central atom in \([\text{BrF}_4^-]\), \(\text{XeF}_4\) and \([\text{SbCl}_6]^3-\) are, respectively.
(A) 1, 0 and 0  (B) 2,1 and 1
(C) 2,1 and 0  (D) 2,0 and 1

082. Which one is not the property of crystalline solid?
(A) Sharp melting point
(B) A definite and regular geometry
(C) High intermolecular forces
(D) isotropic

083. For a non-volatile solute:
(A) vapour pressure of solvent is zero
(B) vapour pressure of solution is more than vapour pressure of solvent
(C) all of the options
(D) vapour pressure of solute is zero

084. Micelles are:
(A) associated colloids
(B) adsorbed catalyst
(C) ideal solution
(D) gel

085. Milk is an emulsion in which:
(A) a solid is dispersed in water
(B) a gas is dispersed in water
(C) lactose is dispersed in water
(D) Milk fat is dispersed in water

086. If enthalpies of formation for \(\text{C}_2\text{H}_4(g)\), \(\text{CO}_2(g)\) and \(\text{H}_2\text{O}(l)\) at 25º C and 1 atm pressure be 52, –394 and –286 kJ mol\(^{-1}\) respectively, enthalpy of combustion of \(\text{C}_2\text{H}_4(g)\) will be
(A) +1412 kJ mol\(^{-1}\)  (B) –141.2 kJ mol\(^{-1}\)
(C) –1412 kJ mol\(^{-1}\)  (D) +141.2 kJ mol\(^{-1}\)

087. Which graph shows zero activation energy for reaction?

```
(A)  \[ \text{BrF}_4^-\cdot\text{XeF}_4\cdot\text{SbCl}_6\cdot\] \[\text{BrF}_4^-\cdot\text{XeF}_4\cdot\text{SbCl}_6\cdot\]
(B)  \[ \text{BrF}_4^-\cdot\text{XeF}_4\cdot\text{SbCl}_6\cdot\]
(C)  \[ \text{BrF}_4^-\cdot\text{XeF}_4\cdot\text{SbCl}_6\cdot\]
(D)  \[ \text{BrF}_4^-\cdot\text{XeF}_4\cdot\text{SbCl}_6\cdot\]
```

086. यदि \(\text{C}_2\text{H}_4(g)\), \(\text{CO}_2(g)\) और \(\text{H}_2\text{O}(l)\) के लिए 25º C एक बायुमण्डलीय द्रव पर विचार की एनेल्पार क्रमांक: 52, –394 और –286 किलो जूल मोल\(^{-1}\) है, \(\text{C}_2\text{H}_4(g)\) द्वारा की एनेल्पार होगी?
(A) +1412 kJ mol\(^{-1}\)  (B) –141.2 kJ mol\(^{-1}\)
(C) –1412 kJ mol\(^{-1}\)  (D) +141.2 kJ mol\(^{-1}\)

087. अभिक्रिया (reaction) के लिए कौनसा ग्राफ विश्लेषण उज्जो दर्शाता है?

```
(A)  \[ \text{BrF}_4^-\cdot\text{XeF}_4\cdot\text{SbCl}_6\cdot\] \[\text{BrF}_4^-\cdot\text{XeF}_4\cdot\text{SbCl}_6\cdot\]
(B)  \[ \text{BrF}_4^-\cdot\text{XeF}_4\cdot\text{SbCl}_6\cdot\]
(C)  \[ \text{BrF}_4^-\cdot\text{XeF}_4\cdot\text{SbCl}_6\cdot\]
(D)  \[ \text{BrF}_4^-\cdot\text{XeF}_4\cdot\text{SbCl}_6\cdot\]
```
088. Which of the following is correct for a first order reaction?
(A) \( t_{1/2} \propto \frac{1}{a} \)  
(B) \( t_{1/2} \propto a^0 \)  
(C) \( t_{1/2} \propto a^2 \)  
(D) \( t_{1/2} \propto a \)

089. 8.50gm of \( \text{NH}_3 \) is present in 250 ml volume. Its active mass is:
(A) 0.5 ML\(^{-1} \)  
(B) 1.5 ML\(^{-1} \)  
(C) 2.0 ML\(^{-1} \)  
(D) 1.0 ML\(^{-1} \)

090. The equilibrium constants of the reaction
\[ \text{SO}_2(g) + \frac{1}{2}\text{O}_2(g) = \text{SO}_3(g) \]
and \( 2\text{SO}_2(g) + \text{O}_2(g) = 2\text{SO}_3(g) \) are \( K_1 \) and \( K_2 \) respectively. The relationship between \( K_1 \) and \( K_2 \) will be:
(A) \( K_2^3 = K_1 \)  
(B) \( K_1 = K_2 \)  
(C) \( K_2 = \sqrt{K_1} \)  
(D) \( K_1 = K_2 \)

091. 
\[ \begin{align*}
\text{COOH} & \quad \text{COOH} \\
\text{H} & \quad \text{H} \\
\text{HO} & \quad \text{HO} \\
\text{CH}_3 & \quad \text{CH}_3 \\
\text{OH} & \quad \text{OH}
\end{align*} \]

pair is known as
(A) threo stereoisomers  
(B) structure isomers  
(C) geometrical isomers  
(D) erythro stereoisomers

092. Which defect in any crystal lowers its density?
(A) Frenkel  
(B) Schottky  
(C) Interstitial  
(D) F centre

093. The half life period of a radio active element is 30 days, after 90 days the following quantity will be left
(A) \( \frac{1}{4} \)  
(B) \( \frac{1}{2} \)  
(C) \( \frac{1}{6} \)  
(D) \( \frac{1}{8} \)

094. What is the number of atoms in the unit cell of body centered cubic crystal?
(A) 2  
(B) 1  
(C) 3  
(D) 4

088. प्रथम कोटि की अभिक्रिया के लिए निम्न में से कौनसा सही है?
(A) \( t_{1/2} \propto \frac{1}{a} \)  
(B) \( t_{1/2} \propto a^0 \)  
(C) \( t_{1/2} \propto a^2 \)  
(D) \( t_{1/2} \propto a \)

089. 250 ml में 8.50 ग्राम अमोनिया उपस्थित है। इसका सहित दृष्टिकोण है -
(A) 0.5 ML\(^{-1} \)  
(B) 1.5 ML\(^{-1} \)  
(C) 2.0 ML\(^{-1} \)  
(D) 1.0 ML\(^{-1} \)

090. अभिक्रिया
\[ \text{SO}_2(g) + \frac{1}{2}\text{O}_2(g) = \text{SO}_3(g) \] और
\[ 2\text{SO}_2(g) + \text{O}_2(g) = 2\text{SO}_3(g) \] के रासायनिक साम्राज्य क्रमशः \( K_1 \) एवं \( K_2 \) है, \( K_1 \) और \( K_2 \) में सम्बन्ध होगा?
(A) \( K_2^3 = K_1 \)  
(B) \( K_1 = K_2 \)  
(C) \( K_2 = \sqrt{K_1} \)  
(D) \( K_1 = K_2 \)

091. 
\[ \begin{align*}
\text{COOH} & \quad \text{COOH} \\
\text{H} & \quad \text{H} \\
\text{HO} & \quad \text{HO} \\
\text{CH}_3 & \quad \text{CH}_3 \\
\text{OH} & \quad \text{OH}
\end{align*} \]

युग कहलाता है
(A) थ्रीयो त्रिविम समावेशी  
(B) संरचना समावेशी  
(C) ज्यामिति समावेशी  
(D) एरिथ्रो त्रिविम समावेशी

092. किसी क्रिस्टल में कौनसी जटिल इसके घनत्व को कम करती है?
(A) फ्रेंकेल  
(B) शोट्की  
(C) अंतराकाशी  
(D) F केन्द्र

093. एक रेडियो सहित तत्व की अर्ध आयु 30 दिन है। 90 दिन बाद उसकी निम्न मात्रा शेष रहेगी?
(A) \( \frac{1}{4} \)  
(B) \( \frac{1}{2} \)  
(C) \( \frac{1}{6} \)  
(D) \( \frac{1}{8} \)

094. काय केन्द्रित घनत्व क्रिस्टल की एकक कोडिका में परसारणों की संख्या क्या होती है?
(A) 2  
(B) 1  
(C) 3  
(D) 4
095. When Grignard reagent reacts with ketone it yields
(A) 2° alcohol  (B) 3° alcohol  (C) Ethanol  (D) 1° alcohol

096. Formula of Bleaching powder is:
(A) CaOCl₂  (B) Ca(OH)₂  (C) CHCl₃  (D) CCl₃CHO

097. The geometry around the central atom in ClF₄⁺ is
(A) square pyramidal  (B) octahedral  (C) trigonal bipyramidal  (D) square planar

098. Among the following, the equilibrium which is NOT affected by an increase in pressure is
(A) H₂(g) + I₂(s) = 2HI(g)
(B) C(s) + H₂O(g) = CO(g) + H₂(g)
(C) 3Fe(s) + 4H₂O(g) = Fe₃O₄(s) + 4H₂(g)
(D) 2SO₂(g) = 2SO₃(g) + O₂(g)

099. In the manufacture of ammonia by Haber’s process
N₂(g) + 3H₂(g) = 2NH₃(g) + 92.3kJ
Which of the following conditions is unfavourable?
(A) Increasing the pressure  (B) Reducing the temperature  (C) Removing ammonia as it is formed  (D) Increasing the temperature

100. Which of the following compounds can exhibit both geometrical isomerism and enantiomerism?
(A) \[
\begin{align*}
\text{CH₃} & \\
\text{CH₂CH₂C_=CH} & \text{CH}_3
\end{align*}
\]
(B) \[
\begin{align*}
\text{CH₃} & \\
\text{CH₂CH₂C_=CH} & \text{COOH}
\end{align*}
\]
(C) CH₃ - CHOH - COOH
(D) CH₃ - CH = CH - CH₃
101. If, \((1 + i\sqrt{3})^2 = a + ib\) Here \(a\) and \(b\) are real, then the value of \(b\) is
(A) 1  
(B) \((\sqrt{3})^2\)  
(C) \((2)^2\)  
(D) 0

102. If \(f(\theta) = 2(\sec^2\theta + \cos^2\theta)\), then its value always
(A) \(f(\theta) = 2\)  
(B) \(4 > f(\theta) > 2\)  
(C) \(f(\theta) \geq 4\)  
(D) \(f(\theta) < 2\)

103. If \(\cot x - \tan x = 2\), then generalized solution is (here \(n\) is integer)
(A) \(x = n\pi + \frac{\pi}{4}\)  
(B) \(x = \frac{n\pi}{2} + \frac{\pi}{8}\)  
(C) \(x = \frac{n\pi}{4} + \frac{\pi}{16}\)  
(D) \(x = 2n\pi + \frac{\pi}{2}\)

104. A plane is flying horizontally at a height of 1Km from ground. Angle of elevation of the plane at a certain instant is 60°. After 20 seconds angle of elevation is found 30°. The speed of plane is
(A) \(\frac{200}{\sqrt{3}}\) m/s  
(B) \(100\sqrt{3}\) m/s  
(C) \(200\sqrt{3}\) m/s  
(D) \(\frac{100}{\sqrt{3}}\) m/s

105. \(\sin^2\theta \cos^3\theta - \sin^4\theta \cos\theta\) is equal
(A) \(\frac{1}{4} \cos\theta \sin 4\theta\)  
(B) \(\frac{1}{2} \sin^2 20\)  
(C) \(\frac{1}{4} \sin\theta \sin 4\theta\)  
(D) \(\frac{1}{2} \cos\theta \sin 4\theta\)

106. If \(2 \sin C \cos A = \sin B\), then \(\Delta ABC\) is
(A) equilateral triangle  
(B) right angle triangle  
(C) none of the options  
(D) Isosceles triangle

107. Value of the \(\tan\left[\frac{1}{2} \cos^{-1}\left(\frac{2}{3}\right)\right]\) is
(A) \(1 - \sqrt{\frac{5}{2}}\)  
(B) \(\frac{1}{\sqrt{5}}\)  
(C) \(\sqrt{\frac{3}{10}}\)  
(D) \(\sqrt{\frac{5}{2}}\)
108. If \( r^2 = x^2 + y^2 + z^2 \) and 
\[ \tan^{-1} \frac{yz}{xy} + \tan^{-1} \frac{xz}{yz} = \frac{\pi}{2} - \tan^{-1} \phi \] then
(A) \( \phi = \frac{yz}{xy} \) (B) \( \phi = \frac{xy}{yz} \)
(C) \( \phi = \frac{xz}{yz} \) (D) \( \phi = \frac{x + y}{2r} \)

109. Consider digits 1, 2, 3, 4, 5, 6 and 7. Using these digits, numbers of five digits are formed. Then probability of these such five digit numbers that have odd digits at their both ends is
(A) \( \frac{2}{7} \) (B) \( \frac{3}{7} \)
(C) None of the options (D) \( \frac{1}{7} \)

110. Out of 100 bicycles, ten bicycles have puncture. What is the probability of not having any punctured bicycle in a sample of 5 bicycles?
(A) \( \frac{1}{2^5} \) (B) \( \frac{1}{2^9} \)
(C) \( \left( \frac{9}{10} \right)^5 \) (D) \( \frac{1}{10^5} \)

111. Probability of solving a particular question by person A is \( \frac{1}{3} \) and probability of solving that question by person B is \( \frac{2}{5} \). What is the probability of solving that question by at least one of them?
(A) \( \frac{2}{3} \) (B) \( \frac{3}{5} \)
(C) \( \frac{7}{9} \) (D) \( \frac{2}{5} \)

112. Four men and three women are standing in a line for railway ticket. The probability of standing them in alternate manner is
(A) \( \frac{1}{33} \) (B) \( \frac{1}{84} \)
(C) \( \frac{1}{7} \) (D) \( \frac{1}{35} \)
113. \(\log_2, \log_6, \log_{12}2\) are in
(A) G.P.  (B) H.P.  
(C) None of the options  (D) A.P.

114. If \(p, q, r, s, t\) and \(u\) are in A.P. then difference \((t-r)\) is equal
(A) \(2(u-q)\)  (B) \(2(s-r)\)  
(C) \(u-q\)  (D) \(2(s-p)\)

115. Value of \([\log_{b}a \log_{c}b \log_{a}c]\)
(A) 1  (B) \(abc\)  
(C) \(\log abc\)  (D) 0

116. If \(p = \frac{1}{\log_{5}x} + \frac{1}{\log_{4}x} + 1\) then
(A) \(2 < p < 2.5\)  (B) \(2.5 < p < 3\)  
(C) \(p > 3\)  (D) \(1.5 < p < 2\)

117. In the expansion of \(\left(\frac{3x^2 + 5}{3x^2}\right)^{10}\)
midterm is
(A) 284  (B) 291  
(C) 242  (D) 252

118. If roots of equation of \(x^2 + x + 1 = 0\) are \(a, b\) and roots of \(x^2 + px + q = 0\)
are \(\frac{a}{b}, \frac{b}{a}\) then value of \(p + q\) is
(A) 1  (B) 2  
(C) \(\frac{\sqrt{2} + 1}{2}\)  (D) \(-1\)

119. The value of Determinant \(\begin{vmatrix} 1/a & bc & a^3 \\ 1/b & ca & b^3 \\ 1/c & ab & c^3 \end{vmatrix}\)
(A) \((a-b)(b-c)(c-a)\)  
(B) \(a^2b^2c^2(a-b)(b-c)(c-a)\)  
(C) None of the options  (D) 0

113. \(\log_2, \log_6, \log_{12}2\) है
(A) G.P.  (B) H.P.  
(C) इनमें से कोई विकल्प नहीं  (D) A.P.

114. यदि \(p, q, r, s, t\) तथा \(u\) समान्तर श्रेणी (A. P.) में हैं तो अंतर \((t-r)\) बराबर है
(A) \(2(u-q)\)  (B) \(2(s-r)\)  
(C) \(u-q\)  (D) \(2(s-p)\)

115. \([\log_{b}a \log_{c}b \log_{a}c]\) का मान है
(A) 1  (B) \(abc\)  
(C) \(\log abc\)  (D) 0

116. यदि \(p = \frac{1}{\log_{5}x} + \frac{1}{\log_{4}x} + 1\) तो
(A) \(2 < p < 2.5\)  (B) \(2.5 < p < 3\)  
(C) \(p > 3\)  (D) \(1.5 < p < 2\)

117. \(\left(\frac{3x^2 + 5}{3x^2}\right)^{10}\) के विस्तार में मध्य पद है
(A) 284  (B) 291  
(C) 242  (D) 252

118. यदि समीकरण \(x^2 + x + 1 = 0\) के मूल \(a, b\)
है तथा \(x^2 + px + q = 0\) के मूल \(\frac{a}{b}, \frac{b}{a}\) तो \(p + q\) का मान है।
(A) 1  (B) 2  
(C) \(\frac{\sqrt{2} + 1}{2}\)  (D) \(-1\)

119. सारणिक \(\begin{vmatrix} 1/a & bc & a^3 \\ 1/b & ca & b^3 \\ 1/c & ab & c^3 \end{vmatrix}\) का मान है
(A) \((a-b)(b-c)(c-a)\)  
(B) \(a^2b^2c^2(a-b)(b-c)(c-a)\)  
(C) इनमें से कोई विकल्प नहीं  (D) 0
120. If \[ \begin{bmatrix} 3 & -1 \\ 0 & 6 \end{bmatrix} \begin{bmatrix} 3x \\ 1 \end{bmatrix} + \begin{bmatrix} -2x \\ 3 \end{bmatrix} = \begin{bmatrix} 8 \\ 9 \end{bmatrix}, \] the value of \( x \) is
(A) \(-\frac{2}{9}\)  
(B) \(-\frac{3}{8}\)  
(C) None of the options  
(D) 7

121. Consider \( A \) and \( B \) two square matrices of same order. Select the correct alternative
(A) If \( AB = 0 \) either \( A \) or \( B \) must be zero matrix  
(B) \(|AB|\) must be greater than \(|A|\)  
(C) \( \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix} \) is not unit matrix.  
(D) \(|A + B|\) must be greater than \(|A|\)

122. Function \( f : N \to N, f(x) = 2x + 3 \) is
(A) One-one Into function  
(B) Many-one Onto function  
(C) Many-one Into function  
(D) One-one Onto function

123. If domain of the function \( f(x) = x^2 - 6x + 7 \) is \((-\infty, \infty)\) then its range is
(A) \([-2, \infty)\)  
(B) \([-2, 3]\)  
(C) \((-\infty, -2)\)  
(D) \((-\infty, \infty)\)

124. The resultant of two forces \( P \) and \( Q \) is of magnitude \( P \). If the force \( P \) is doubled, \( Q \) remaining the same, then angle between new resultant and the force \( Q \) is
(A) 45°  
(B) 60°  
(C) 90°  
(D) 30°

125. The centre of gravity (centre of mass) of a rod (of length \( L \)) whose linear mass density varies as the square of the distance from one end is at
(A) \( \frac{3L}{4} \)  
(B) \( \frac{3L}{5} \)  
(C) \( \frac{2L}{5} \)  
(D) \( \frac{L}{3} \)
126. Three forces each of magnitude \( F \) are applied along the edges of a regular hexagon as shown in the figure. Each side of hexagon is \( a \). What is the resultant moment (torque) of these three forces about centre \( O \)?

- (A) \( \frac{\sqrt{3}}{2} aF \)
- (B) \( \frac{3\sqrt{3}}{2} aF \)
- (C) \( \frac{1}{2} aF \)
- (D) \( 3aF \)

127. The coordinates of a moving point particle in a plane at time \( t \) is given by \( x = a(t + \sin t) \), \( y = a(1 - \cos t) \). The magnitude of acceleration of the particle is

- (A) \( \sqrt{3} a \)
- (B) \( 2a \)
- (C) \( \frac{\sqrt{3}}{2} a \)
- (D) \( a \)

128. A body of mass \( m \) falls from rest through a height \( h \) under gravitation acceleration \( g \) and is then brought to rest by penetrating through a depth \( d \) into some sand. The average deceleration of the body during penetration into sand is

- (A) \( \frac{gd}{h} \)
- (B) \( \frac{gh^2}{d} \)
- (C) \( \frac{gh}{2d} \)
- (D) \( \frac{gh}{d} \)

129. A normal is drawn at a point \( (x_1, y_1) \) of the parabola \( y^2 = 16x \) and this normal makes equal angle with both \( x \) and \( y \) axes. Then point \( (x_1, y_1) \) is

- (A) \( (2, -8) \)
- (B) \( (4, -8) \)
- (C) \( (1, -4) \)
- (D) \( (4, -4) \)

130. Two vectors \( A = 3 \) and \( B = 4 \) are perpendicular. Resultant of both these vectors is \( R \). The projection of the vector \( B \) on the vector \( R \) is

- (A) \( 2.4 \)
- (B) \( 5 \)
- (C) \( 1.25 \)
- (D) \( 3.2 \)
132. A vector \( \mathbf{R} \) is given by \( \mathbf{R} = \mathbf{A} \times (\mathbf{B} \times \mathbf{C}) \)
Which of the following is true?
(A) \( \mathbf{R} \) must be parallel to \( \mathbf{B} \)
(B) \( \mathbf{R} \) must be perpendicular to \( \mathbf{B} \)
(C) None of the options
(D) \( \mathbf{R} \) is parallel to \( \mathbf{A} \)

133. Solution of the differential equation \( \frac{dy}{dx} = 2e^{-y} + x^2 e^{-y} \) is
(A) \( e^y = 2e^{-x} + \frac{x^3}{3} + c \)
(B) \( e^y = 2e^{-x} + \frac{x^3}{3} + c \)
(C) \( e^{-y} = 2e^x + \frac{x^3}{3} + c \)
(D) \( e^{-y} = 2e^x + \frac{x^3}{3} + c \)

134. Solution of the differential equation \((x + 2y^3) \frac{dy}{dx} = y\) is
(A) \( xy + y + c \)
(B) \( y^3 + cx = y \)
(C) \( \frac{xy^4}{2} + xy = cy \)
(D) \( y^3 + cy = x \)

135. Value of the following expression is \( \lim_{n \to \infty} \frac{1}{n} (1^3 + 2^3 + 3^3 + \ldots + n^3) \)
(A) \( \frac{1}{6} \)
(B) \( \frac{1}{2} \)
(C) \( \frac{2}{3} \)
(D) \( \frac{1}{3} \)

136. If function \( f(x) = \begin{cases} x \sin\left(\frac{1}{x}\right) ; x \neq 0 \\ a ; x = 0 \end{cases} \)
is continuous at \( x = 0 \), then value of \( a \) is
(A) \(-1\)
(B) \(0\)
(C) None of the options
(D) \(1\)

137. The derivative of \( y = x^{\sin x} \) is
(A) \( \frac{\sin 2x}{2} x^{\sin x - 1} \)
(B) \( x^{\sin x} \left( \cos x \log x + \frac{\sin x}{x} \right) \)
(C) \( \cos x \log x + \frac{\sin x}{x} \)
(D) \( \cos x x^{\sin x - 1} \)
138. The tangents to curve 
\[ y = x^3 - 2x^2 + x - 2 \] 
which are parallel to straight line \( y = x \) are 
(A) \( x + y = 2 \) and \( x + y = \frac{86}{27} \) 
(B) \( x + y = 2 \) and \( x - y = \frac{86}{27} \) 
(C) \( x - y = 2 \) and \( x - y = \frac{86}{27} \) 
(D) \( x - y = 2 \) and \( x + y = \frac{86}{27} \)

139. The value of \( \lim_{x \to 0} \frac{\cos hx - \cos x}{x \sin x} \) is 
(A) \( \frac{1}{2} \)  (B) \( \frac{1}{3} \)  (C) 2  (D) 1

140. Value of Maxima of \( \left( \frac{1}{x} \right)^x \) is 
(A) \( e^{(\frac{1}{e})} \)  (B) \( \left( \frac{1}{e} \right)^x \)  (C) \( e^x \)  (D) \( e \)

141. The value of the integral \( \int_0^{\frac{\pi}{2}} \frac{\sin^{-1} x}{(1 - x^2)^{3/2}} \, dx \) is 
(A) \( \pi - \frac{1}{2} \log 2 \)  (B) \( \frac{\pi}{2} - \log 2 \)  (C) \( \frac{\pi}{4} - \frac{1}{2} \log 2 \)  (D) \( \frac{\pi}{2} + \frac{1}{2} \log 2 \)

142. Integral of \( \frac{1}{2 + \cos x} \) is 
(A) \( \sin x \log (2 + \cos x) + c \)  
(B) \(\frac{1}{\sqrt{3}} \tan^{-1}\left(\frac{1}{\sqrt{3}} \tan \frac{x}{2}\right) + c \)  
(C) \(\frac{2}{\sqrt{3}} \tan^{-1}\left(\frac{1}{\sqrt{3}} \tan \frac{x}{2}\right) + c \)  
(D) \( -\sin x \log (2 + \cos x) + c \)

143. The eccentricity of an ellipse 
\[ 9x^2 + 16y^2 = 144 \] is 
(A) \( \frac{2}{5} \)  (B) \( \frac{\sqrt{3}}{5} \)  
(C) \( \frac{\sqrt{5}}{3} \)  (D) \( \frac{\sqrt{7}}{4} \)

138. वक्र \( y = x^3 - 2x^2 + x - 2 \) पर खेली गई स्पर्श रेखाओं जो कि सरल रेखा \( y = x \) के समान्तर हैं के समीकरण हैं 
(A) \( x + y = 2 \) and \( x + y = \frac{86}{27} \) 
(B) \( x + y = 2 \) and \( x - y = \frac{86}{27} \) 
(C) \( x - y = 2 \) and \( x - y = \frac{86}{27} \) 
(D) \( x - y = 2 \) and \( x + y = \frac{86}{27} \)

139. \( \lim_{x \to 0} \frac{\cos hx - \cos x}{x \sin x} \) का मान है 
(A) \( \frac{1}{2} \)  (B) \( \frac{1}{3} \)  (C) 2  (D) 1

140. \( \left( \frac{1}{x} \right)^x \) का उच्चतम मान है 
(A) \( e^{(\frac{1}{e})} \)  (B) \( \left( \frac{1}{e} \right)^x \)  (C) \( e^x \)  (D) \( e \)

141. \( \int_0^{\frac{\pi}{2}} \frac{\sin^{-1} x}{(1 - x^2)^{3/2}} \, dx \) के समाकल का मान 
(A) \( \pi - \frac{1}{2} \log 2 \)  (B) \( \frac{\pi}{2} - \log 2 \)  (C) \( \frac{\pi}{4} - \frac{1}{2} \log 2 \)  (D) \( \frac{\pi}{2} + \frac{1}{2} \log 2 \)

142. \( \frac{1}{2 + \cos x} \) का समाकल है 
(A) \( \sin x \log (2 + \cos x) + c \)  
(B) \(\frac{1}{\sqrt{3}} \tan^{-1}\left(\frac{1}{\sqrt{3}} \tan \frac{x}{2}\right) + c \)  
(C) \(\frac{2}{\sqrt{3}} \tan^{-1}\left(\frac{1}{\sqrt{3}} \tan \frac{x}{2}\right) + c \)  
(D) \( -\sin x \log (2 + \cos x) + c \)

143. दिखाए गए दीर्घवृत्त 
\[ 9x^2 + 16y^2 = 144 \] की उत्क्रमता है 
(A) \( \frac{2}{5} \)  (B) \( \frac{\sqrt{3}}{5} \)  
(C) \( \frac{\sqrt{5}}{3} \)  (D) \( \frac{\sqrt{7}}{4} \)
144. Taking axes of hyperbola as coordinate axes, find its equation when the distance between the foci is 16 and eccentricity is \( \sqrt{2} \)
(A) \( x^2 - y^2 = 16 \) (B) \( x^2 - y^2 = 32 \)
(C) \( x^2 - y^2 = 64 \) (D) \( x^2 - y^2 = 8 \)

145. For a circle \( x^2 + y^2 = 81 \), what is the equation of chord whose mid point is \((-2, 3)\)
(A) \( 2x + 3y + 13 = 0 \) (B) \( x + 3y = 0 \)
(C) \( 3x - 2y + 13 = 0 \) (D) \( 2x - 3y - 13 = 0 \)

146. The condition so that the line \( lx + my + n = 0 \) may touch the parabola \( y^2 = 8x \)
(A) \( m^2 = 2l \) (B) \( 8m^2 = l \)
(C) \( 2m^2 = l \) (D) \( m^2 = 8l \)

147. The equation of that diameter of the circle \( x^2 + y^2 - 6x + 2y - 8 = 0 \) which passes through the origin is
(A) \( 3x + 2y = 0 \) (B) \( x + 3y = 0 \)
(C) \( 3x - y = 0 \) (D) \( 6x - y = 0 \)

148. If \( z \) is a complex number then \((z + 5)(\overline{z} + 5)\) is
(A) \( |z + 5|^2 \) (B) \( |z + 5i|^2 \)
(C) \( |z - 5|^2 \) (D) \( (z + 5)^2 \)

149. If \( z \) is a complex number then which of the following statement is true?
(A) \( (z + \overline{z}) \) is purely imaginary
(B) \( (z \overline{z}) \) is purely imaginary
(C) \( (z \overline{z}) \) is nonnegative real
(D) \( (z - \overline{z}) \) is purely real

150. If \( \omega \) is the cubic root of unity, then value of the \((1 + \omega - \omega^2)^2 + (1 - \omega + \omega^2)^2 + 1\) is
(A) \(-3\) (B) \(-1\)
(C) \(7\) (D) \(1\)