प्रश्न पत्र

2018 (II)
रसायन विज्ञान

अनुदेश

1. अनले दिनी के नाममय पुर्ता है। इन एवटा पुर्तिका में एक जीता (20 वाट 'A' में + 40 वाट 'B' में + 60 वाट 'C' में) तेज किया जा सकता है। अनले दिनी 'A' में और 'B' में + 40 वाट 'C' में बड़ा दिकोलासी (NACI) हो जाएगा। दिनी 'A' में से अवस्थान 15 और 'B' में से 35 वाट तथा 'C' में से 25 वाटों का खंडहर बनेगा। मैं इसलिए साधन प्रवाह के साथ मिला जा सकता है ताकि उसकी प्रवीणता को बढ़ाने ही मिला। दिनी 'A' में 15, दिनी 'B' में 35 तथा 'C' में 35 तक को की जाएगी।

2. अनले दिनी, प्रदर्शन प्रकाश अनले से जहाँ वाट मिलने के लिए प्रवाह हो। इन प्रकाश के फूडु क्षेत्र के लिए इन प्रवाहों को बढ़ाना होगा ताकि प्रवाल तक प्रवाह हो। इन प्रवाल के लिए इन प्रवालों का अनुपात प्रदर्शित किया जाएगा।

3. अनले, प्रदर्शन प्रकाश के पक्ष 1 में दिए गए प्रश्न का दिरो प्रदर्शित हो जाएगा। दिरो प्रदर्शन का अनुपात प्रदर्शित किया जाएगा।

4. अनले प्रदर्शन 'A', 'B', 'C' वाट के साथ, विभिन्न प्रकाश, पुरीतिका कोड और प्रदर्शन कोड से प्रदर्शित किया जाएगा। यह एक प्रदर्शन प्रकाश की चिनाई है। इन प्रकाशों के प्रवाल को बढ़ाना होगा ताकि प्रदर्शन के प्रवाल तक प्रवाल हो। इन प्रवाल के लिए इन प्रवालों की अनुपात प्रदर्शित किए जाएंगे।

5. 'A' वाट 'B' में प्रदर्शन '3' के साथ, 'A' वाट 'B' में प्रदर्शन '4' के साथ। 'A' वाट 'B' में प्रदर्शन '3' के साथ, 'A' वाट 'B' में प्रदर्शन '4' के साथ।

6. प्रदर्शन प्रकाश का प्रवाल विश्वास किया जाएगा। इसलिए यह एक प्रवाल ज्ञात में "कार्यकर्ता" कहा जाएगा।

7. प्रदर्शन प्रकाश का प्रवाल विश्वास किया जाएगा। इसलिए यह एक प्रवाल ज्ञात में "कार्यकर्ता" कहा जाएगा।

8. प्रदर्शन का प्रवाल विश्वास किया जाएगा। इसलिए यह एक प्रवाल ज्ञात में "कार्यकर्ता" कहा जाएगा।

9. प्रदर्शन का प्रवाल विश्वास किया जाएगा। इसलिए यह एक प्रवाल ज्ञात में "कार्यकर्ता" कहा जाएगा।

10. प्रदर्शन का प्रवाल विश्वास किया जाएगा। इसलिए यह एक प्रवाल ज्ञात में "कार्यकर्ता" कहा जाएगा।

11. प्रदर्शन का प्रवाल विश्वास किया जाएगा। इसलिए यह एक प्रवाल ज्ञात में "कार्यकर्ता" कहा जाएगा।

12. प्रदर्शन का प्रवाल विश्वास किया जाएगा। इसलिए यह एक प्रवाल ज्ञात में "कार्यकर्ता" कहा जाएगा।

स/27 CISH/2018-1BH-1A
INSTRUCTIONS

1. This Test Booklet contains one hundred and twenty (20 Part 'A' + 60 Part 'B' + 40 Part 'C') Multiple Choice Questions (MCQs). You are required to answer a maximum of 35 and 25 questions from part 'A', 'B' and 'C' respectively. If more than required number of questions are answered, only first 35 and 25 questions in parts 'A', 'B' and 'C', respectively, will be taken up for evaluation.

2. OMR answer sheet has been provided separately. Before you start filling up your particulars, please ensure that the booklet contains requisite number of pages and that there are no torn or mutilated. If it is so, you may request the invigilator to change the booklet of the same code. Likewise, check the OMR answer sheet also. Sheets for rough work have been appended to the test booklet.

3. Write your Roll No., Name and Serial Number of this Test Booklet on the OMR answer sheet in the space provided. Also put your signatures in the space earmarked.

4. You must darken the appropriate circles with a black ball pen related to Roll Number, Subject Code, Booklet Code and Centre Code on the OMR answer sheet. It is the sole responsibility of the candidate to meticulously follow the instructions given on the Answer Sheet, failing which the computer shall not be able to decipher the correct details which may ultimately result in loss, including rejection of the OMR answer sheet.

5. Each question in Part 'A' and 'B' carry 2 marks and Part 'C' questions carry 4 marks each, respectively. There will be negative marking @ 0.50 mark for each wrong answer in Part 'A' and 'B' and @ 1 mark for Part 'C'.

6. Below each question in Part 'A', 'B' and 'C' four alternatives or responses are given. Only one of these alternatives is the "correct" option to the question. You have to find, for each question, the correct or the best answer.

7. Candidates found copying or resorting to any unfair means are liable to be disqualified from this and future examinations.

8. Candidate should not write anything anywhere except on answer sheet or sheets for rough work.

9. Use of calculator is NOT permitted.

10. After the test is over, at the perforation point, tear the OMR answer sheet, hand over the original OMR answer sheet to the invigilator and retain the carbonless copy for your record.

11. Candidates who sit for the entire duration of the exam will only be permitted to carry their Test booklet.
भाग/PART - A

1. अनुसारत्व कार्य के बेलनाकार पात्र है एक कीर्ति को उच्चता अनुसार में घुमे पात्र के तांत्र को दर्शाया गया है। धाराके, गैजल में इस तात्र उड़ता जाता है कि कीर्ति में 2 घुमाव तक उड़ सकता है। गैजल बर्तन कार्य में नकाय की गति x दूरी (x < x1) तक दर्शाया जाता है। तब कीर्ति में पात्र कर्फ़त तल

2. सत्ता छटाओं के अंक (30 अंक में से) एक परिवर्तन में 4, 15, 6, 7, 5, 4, 0 तथा 5 है। यह परिवर्तन (x > 0) 4 का मूल्य है, तब 8 एक अवयव अंक है। इस समूह में अवयव है। समूहों का अंक में विभाज्यता से अंक अंक तथा अंक है?
1. 25
2. 26
3. 27
4. 29

2. मार्क्स (out of 30) of seven students in an examination are 4, 15, 6, 7, 5, a and b, where a (> 0) is a multiple of 4 and b is a prime. What is the maximum possible value of the difference between the maximum and minimum marks?
1. 25
2. 26
3. 27
4. 29

3. दो व्यक्ति A और B एक बिंदु तिसरी विस्तारों में घड़ी के बावजूद बढ़ते हैं। A की गति B से दुकान है। B की गति 1 km/hr है।

<table>
<thead>
<tr>
<th>दूरी (किमी)</th>
<th>क्रमर (किमी प्रति घंटा)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 किमी प्रति घंटा</td>
<td>A और B के दोनों</td>
</tr>
<tr>
<td>3 किमी प्रति घंटा</td>
<td>A और B के दोनों</td>
</tr>
</tbody>
</table>

3. Two persons A and B start walking in opposite directions from a point. A travels twice as fast as B. The speed at which B travels is 1 km/hr. If A travels 2 km and turns back and starts walking towards B, at what distance from the starting point will A cross B?
1. 2 km
2. 4 km
3. 6 km
4. 8 km

4. एक व्यक्ति काम से चालान से आकलन तक 60 km/hr की औसत गति से चलता प्रत्यवेदित है। चालान से आकलन की दूरी 2 km है। अध्ययन केंद्र व्यक्ति की बाज़ में वह बह रहे एक फलबोहर में बेजू के साथ है। 30 km/hr की औसत गति से बाज़ सबक. भीष्म कुजुमक के अध्ययन में वह बेजू हुआ दूरी से भी किस गति से जाता है कि 60 km/hr की औसत गति के साथ कितना दूरी पहुँचता है?
4. A person wanted to travel from Charbagh to Alambagh with an average speed of 60 km/h by car. The distance between Charbagh and Alambagh is 2 km. Due to heavy traffic, he could travel at 30 km/h for the first kilometre of his journey. What should his speed be for the remaining journey to achieve his average speed target of 60 km/h?

1. Cannot achieve his target with any finite speed.
2. 60 km/h
3. 90 km/h
4. 120 km/h

5. **(Hindi Text)**

6. In a four consecutive day schedule, four pilots flew flights each on a different day. Mr. A was scheduled to work on Monday, but he traded with Ms. B who was originally scheduled to work on Wednesday. Ms. C traded with Mr. D, who was originally scheduled to work on Thursday. After all the switching was done, who worked on Tuesday?

1. Mr. A
2. Mr. D
3. Ms. B
4. Ms. C

7. The annual rainfall of a particular region is given by the formula: 

$$\text{Rainfall} = \frac{1}{2} \pi r^2 h$$

where $r$ is the radius of the region and $h$ is the height of the rainfall. If the region has a radius of 10 km and a height of 15 km, what is the annual rainfall in that region?

1. 785 km
2. 1570 km
3. 314 km
4. 628 km

8. **(Hindi Text)**

9. **(Hindi Text)**
9. How many different vegetables can be made from cauliflower, tomatoes, onions, potatoes and carrots?
1. 16
2. 28
3. 31
4. 32

10. A bottle of perfume is opened and a person at a distance of 10 m gets the smell after 10 seconds. The time taken for a person 20 m away to get the smell is about
1. 20s
2. 40s
3. 14s
4. 80s

11. A mineral contains a cubic and a spherical cavity. The length of the side of the cube is the same as the diameter of the sphere. If the cubic cavity is half filled with a liquid and the spherical cavity is completely filled with liquid, what is the approximate ratio of the volume of liquid in the cubic cavity to that in the spherical cavity?
1. 2:1
2. 1:1
3. 1:2
4. 1:4

12. 6 unbiased coins are tossed. 5 are tossed independently and they all result in heads. If the 6th is now independently tossed, the probability of getting a head is
1. 1
2. 2
3. 1/2
4. 1/6

13. What could the fourth figure in the sequence be?

1. 2:1
2. 1:1
3. 1:2
4. 1:4
14. A, B, and C's ages are 30, 31, and z years respectively. If z is the minimum possible value of x (x ≤ y ≤ z), then what is the maximum age of A, B, and C? 

1. 22
2. 23
3. 33
4. 37

15. The average age of A, B, and C, whose ages are integers x, y, and z respectively (x ≤ y ≤ z), is 30. If the age of B is exactly 5 more than that of A, what is the minimum possible value of z? 

1. 31
2. 33
3. 35
4. 37

16. A pie chart shows the percentage-wise distribution of students in different sub-areas, where a student takes one and only one sub-area. What percentage of the total science students is girls studying quantum mechanics? 

1. 10
2. 1
3. 0.2
4. 2

16. What is the total number of parallelograms in the given diagram? 

1. 27
2. 24
3. 22
4. 14
17. Two sets of three vertices, 

\[
\begin{array}{|c|c|c|c|c|c|}
\hline
\text{Set} & A & B & C & D & E \\
\hline
\text{Vertices} & 1, 2, 3 & 4, 5, 6 & 7, 8, 9 & 10, 11, 12 & 13, 14, 15 \\
\hline
\text{Edges} & 1-2, 2-3, 3-1 & 4-5, 5-6, 6-4 & 7-8, 8-9, 9-7 & 10-11, 11-12, 12-10 & 13-14, 14-15, 15-13 \\
\hline
\end{array}
\]

18. The diagram shows the dimensions (in cm) of a zircon crystal having a square prism and two identical square pyramids. What is the volume of this crystal (in cm³)?

\[
\text{Volume} = \text{Base area} \times \text{Height} = 0.3 \times 0.3 \times 3 = 0.27 \text{ cm³}
\]

19. A boy throws a ball with a speed \( v \) at a vehicle that is approaching him with a speed \( v \). After bouncing, the ball hits the boy with a speed \( v \). Which of the following equations correctly represent the situation?

\[
\begin{align*}
1. & \quad v + v \\
2. & \quad v + 2v \\
3. & \quad v + v \\
4. & \quad v + 4v 
\end{align*}
\]

20. If \( a \) and \( b \) are positive integers, and \( a > b \), the product of the first \( n \) positive integers is given by \( n! \). Find the value of \( n! \) if \( n = 10 \).

\[
10! = 3,628,800
\]
20. Four friends were sharing a pizza. They decided that the oldest friend will get an extra piece of pizza. Bahu is two months older than Kattappa, who in turn is three months younger than Bhalla. Devsena is one month older than Kattappa. Who should get the extra piece of pizza?

21. CN⁻ and O₂⁻ to LUMO के साथ हैं, क्रमाः
1. χ₁ तथा \( \pi_1 \)
2. \( \pi_1 \) तथा \( \sigma_1 \)
3. \( \pi_2 \) तथा \( \sigma_2 \)
4. \( \sigma_2 \) तथा \( \pi_2 \)

22. अधीन मार्गारण में \([Ca(NCS)XH₂O]⁺\) तथा \([Fe(H₂O)₆]³⁺\) के नमूने अभिक्रिया. जो \([Co(H₂O)₆]³⁺\) तथा \([Fe(H₂O)₆]³⁺\) उस्मण करती है, \(X\) निर्धारित \([Fe(SCN)XH₂O]⁺\) की बहुत हुई है।
अभिक्रिया की विभागीय है
1. विद्युत्न्य विभागीय
2. सारण्य विभागीय
3. आतंकवक्ष विभागीय स्थानावर्गीय
4. वहाँ है विभागीय स्थानावर्गीय

23. The chelate rings formed by macrocyclic ligands in vitamin B₁₂ are
1. one five-membered and three six-membered
2. two five-membered and two six-membered
3. three five-membered and one six-membered
4. four six-membered

24. EDTA²⁻ के निम्नलिखित संघटन में N-दात तथा O-दात के केंद्र की संख्या है, क्रमाः
1. दो तथा चार
2. दो तथा दो
3. तीन तथा छः
4. दो तथा आठ

25. The intermediate \([Fe(SCN)XH₂O]⁺\) is decomposed in the reaction of \([Ca(NCS)XH₂O]⁺\) with \([Fe(H₂O)₆]³⁺\) in aqueous medium to produce \([CaH₂O]⁺\) and \([Fe(SCN)XH₂O]⁺\). The mechanism of the reaction is
1. Interchange dissociative
2. Interchange associative
3. Inner sphere electron transfer
4. Outer sphere electron transfer

26. The chelate rings made by macrocyclic ligands in vitamin B₁₂ are
1. One five-membered and three six-membered
2. Two five-membered and two six-membered
3. Three five-membered and one six-membered
4. Four six-membered

27. For magnesium complex of EDTA²⁻, the number of N-donor and O-donor centers, are respectively,
1. Two and four
2. Two and two
3. Two and six
4. Two and eight
25. The correct set of electronic configurations for metal ions in octahedral coordination geometry for iron, Teller distortion is
1. $\text{t}_2^8 \text{e}_g^6$, $\text{t}_2^7 \text{e}_g^6 \text{e}_u$, $\text{t}_2^6 \text{e}_g^6 \text{e}_u^2$, $\text{t}_2^5 \text{e}_g^6 \text{e}_u^3$
2. $\text{t}_2^8 \text{e}_g^6$, $\text{t}_2^7 \text{e}_g^6 \text{e}_u$, $\text{t}_2^6 \text{e}_g^6 \text{e}_u^2$, $\text{t}_2^5 \text{e}_g^6 \text{e}_u^3$
3. $\text{t}_2^8 \text{e}_g^6$, $\text{t}_2^7 \text{e}_g^6 \text{e}_u^2$, $\text{t}_2^6 \text{e}_g^6 \text{e}_u^3$, $\text{t}_2^5 \text{e}_g^6 \text{e}_u^4$
4. $\text{t}_2^8 \text{e}_g^6$, $\text{t}_2^7 \text{e}_g^6 \text{e}_u^2$, $\text{t}_2^6 \text{e}_g^6 \text{e}_u^3$, $\text{t}_2^5 \text{e}_g^6 \text{e}_u^4$

26. The correct order of acceptor ability of the phosphorus ligands is
1. PMe₃ > PPh₃ > P(OH)₃ > PF₃
2. PF₃ > P(OH)₃ > PPh₃ > PMe₃
3. PMe₃ > P(OH)₃ > PF₃ > PPh₃
4. P(OH)₃ > PF₃ > PPh₃ > PMe₃

27. The correct answer is (a). The ¹¹B NMR spectrum of a diamagnetic complex [M(Pr₅)Cl₃] (M = transition metal, 1 = 0) expected number of resonance(s) is
1. Three
2. Two
3. One
4. Six

28. The correct answer is (d). The number of paramagnetic species among them and the EPR inactive species, respectively, are
1. 4 and $d^5$
2. 4 and $d^6$
3. 5 and VO⁺⁺⁺⁺, Cu⁺⁺⁺⁺
4. 2 and NO, Cu⁺⁺⁺⁺

29. CO is known to be blameless/innocent.
(a) CO is a weak acid.
(b) CO is a strong acid.
(c) CO is a weak base.
(d) CO is a strong base.

Answer is (b).

30. The correct answer is (a). The oxidation state of Co in the compound is +3.

<table>
<thead>
<tr>
<th>Option</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>$\text{Co}^{3+}$</td>
</tr>
<tr>
<td>(b)</td>
<td>$\text{Co}^{4+}$</td>
</tr>
<tr>
<td>(c)</td>
<td>$\text{Co}^{2+}$</td>
</tr>
<tr>
<td>(d)</td>
<td>$\text{Co}^{1+}$</td>
</tr>
</tbody>
</table>

The correct answer is (a) $\text{Co}^{3+}$. 

1:0:N
30. Match the items of Column I with those of Column II.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Laser source</td>
<td>i. Electron Capture Detector</td>
</tr>
<tr>
<td>b. Thermometric titration</td>
<td>ii. Polarography</td>
</tr>
<tr>
<td>c. Gelatin</td>
<td>iii. Heat of reaction</td>
</tr>
<tr>
<td>d. Gas-liquid chromatography</td>
<td>iv. Spectrofluorimetry</td>
</tr>
</tbody>
</table>

Correct answer is:
1. a-iv; b-iii; c-ii; d-iv
2. a-iv; b-iii; c-iv; d-ii
3. a-i; b-ii; c-ii; d-ii
4. a-iii; b-ii; c-iv; d-i

31. अभिक्रियाओं PF₃, SbF₅, PH₃, तथा SnH₄ पर विभिन्न क्रियाओं पर विश्लेषण के लिए PF₃, SbF₅, PH₃, तथा SnH₄ पर विभिन्न क्रियाओं पर विश्लेषण के लिए.

32. Consider compounds PF₃, SbF₅, PH₃ and SnH₄. The strongest acid and the strongest base among these are, respectively,
1. PF₃ and PH₃
2. SbF₅ and PH₃
3. SbF₅ and SnH₄
4. PF₃ and SnH₄

33. Among SICl₄, P(O)Cl₃, N₂, trans-[SnCl₆(py)₂] (py = pyridine), those with zero dipole moment are:
1. SICl₄ and N₂
2. SICl₄, P(O)Cl₃ and trans-[SnCl₆(py)₂]

34. Among the following, the compound that will have highest rate for nucleophilic substitution through SnI mechanism is

![Chemical Structure](image-url)
35. The major product formed in the following reaction is

\[ \text{Phenylamine} + \text{Acetic Acid} \rightarrow \text{Product} \]

36. The mechanism of acid-catalyzed hydrolysis of benzyl ester involves the following steps:

\[ \text{Product} + \text{Water} \rightarrow \text{Product} + \text{Water} \]
37. In the energy profile diagram of the reaction given below, the species A would correspond to the position

1. I  2. II  3. III  4. IV

38. Following reaction is an example of


39. In IR spectra, the stretching frequency (in cm\(^{-1}\)) of the carbonyl group of the following compounds is in the order

40. The order of relative rate of cyclization of following bromoacrylates to generate corresponding lactones is

1. B > A > C  
2. A > C > B  
3. B > C > A  
4. C > B > A

42. The major product formed in the following reaction is

1.  
2.  
3.  
4.  

1. optically inactive as it is racemic mixture  
2. optically inactive as it is meso
43. The order of reactivity of the following alkenes towards Diels-Alder reaction is:

1. B > A > C
2. A > C > B
3. B > C > A
4. C > B > A

44. Among the following, the optically active compound is:

1.  
2.  
3.  
4.  

45. The order of reactivity of the following reaction(s) which provide(s) 1-butane as the major product is (are):

1. A alone
2. A and B
3. A and C
4. C and D

46. The following reaction with sodium bicarbonate is:

1.  
2.  
3.  
4.  

1-BH
46. The major product formed in the following reaction is

\[ \text{OH} \rightarrow \text{CO}_2 \text{H} \]  
\[ \text{aq. NaHCO}_3 \]

1. 150
2. 125
3. 100
4. 75

47. The internal pressure of a liquid drop (radius = 10^{-4} m) is greater than the external pressure by \( 1.5 \times 10^4 \) N m^{-2}. The surface tension (mN m^{-1}) of the liquid is closest to

1. 150
2. 125
3. 100
4. 75

48. The difference between (111) and (222) plane distances is largest for the (001) plane. Which of the following planes have the same spacing?

1. (111)
2. (222)
3. (100)
4. (010)

49. The dispersity of a polymeric sample is

1. 1.0
2. 1.5
3. 2.0
4. 2.5

50. The ketone-hexose among the following is

1. Xylose
2. Fructose
3. Galactose
4. Mannose

51. The uncertainty in the position of a moving electron is 100 pm. The uncertainty in its speed is closest to (\( m_r = 9.11 \times 10^{-31} \) kg; \( h = 6.63 \times 10^{-34} \) Js)

1. 6.0 \times 10^4 m s^{-1}
2. 6.0 \times 10^5 m s^{-1}
3. 6.0 \times 10^6 m s^{-1}
4. 6.0 \times 10^7 m s^{-1}

52. The unit cell dimensions of a particular crystal are 16956.2 and 16973.4 cm^{-1} respectively. What is the angle between the two axes?

1. 1\^\circ_{10}
2. 2\^\circ_{10}
3. 3\^\circ_{10}
4. 4\^\circ_{10}
52. The spectrum of sodium atom has a closely separated doublet at 66962.6 and 66973.4 cm\(^{-1}\). The higher energy transition is due to
1. \(^2\)P\(_{1}\) \(\rightarrow\) \(^2\)S\(_{1}\)
2. \(^2\)P\(_{3}\) \(\rightarrow\) \(^2\)S\(_{1}\)
3. \(^2\)P\(_{1}\) \(\rightarrow\) \(^2\)P\(_{1}\)
4. \(^2\)S\(_{1}\) \(\rightarrow\) \(^2\)S\(_{1}\)

53. N\(_2\)O gas is in the ground state. The ground state of N\(_2\)O is:
1. \(D\(_{2}\)\)
2. \(C\(_{2v}\)\)
3. \(C\(_{2v}\)\)
4. \(S\(_{1}\)\)

54. By the method of forces of 3-4-5 rule, the correct statement is:
1. \(\Delta U = T\Delta S - P\Delta V\)
2. \(\Delta G = T\Delta S + P\Delta V\)
3. \(\Delta U = T\Delta S + P\Delta V\)
4. \(\Delta U = P\Delta S - T\Delta P\)

55. The volume change at a certain phase transition is 2.0 \(\text{mL mol}^{-1}\) at the transition point. From this, we may conclude that the transition is most likely a
1. first order phase transition
2. second order phase transition
3. third order phase transition
4. a phase transition

56. The activation energy of a reaction reduces by 12 kcal mol\(^{-1}\) in the presence of an enzyme at 300 K. Assuming pseudo-first order kinetics, calculate the factor by which the reaction rate is increased. (Given: \(k = 2\) cal K\(^{-1}\) mol\(^{-1}\))
1. \(2 \times 10^9\)
2. \(1.02\)
3. \(8.70 \times 10^9\)
4. \(5 \times 10^9\)
59. सिद्धिविरल में से कोई कथन है?
1. लघु तेल की आवश्यकता दो अर्ध सेक्टर के विकसित के लिए होती है।
2. लघु तेल दो अर्ध सेक्टर के भाग विभाजित पारा-वाले के शिखर विकसित के लिए आवश्यकता है।
3. लघु तेल अवधि में दस्तावेज जल्द से होता है।
4. लघु में अ-विशुद्ध संयुक्त एक में होता है।

59. The correct statement among the following is:
1. Salt bridge is required for the mixing of the solutions in the two half-cells.
2. Salt bridge allows current to flow between the half-cells without mixing the solutions.
3. Salt bridge enhances the rate of the reaction.
4. Salt bridge consists of a non-electrolyte in a gel.

60. अनुश्रुतिया AgBr(s) → Ag⁺(aq) + Br⁻(aq)
की मानक दुर्गति उच्च (E°(AgBr/Ag, Br⁻) = +0.17 V, E°(Ag/Ag⁺) = 0.80 V, F = 96500 C mol⁻¹)
दिख के निदेशांक हैं, यह है:
1. 7 kJ mol⁻¹
2. 70 J mol⁻¹
3. 70 kJ mol⁻¹
4. 7 J mol⁻¹

60. The standard free energy of the reaction
AgBr(s) → Ag⁺(aq) + Br⁻(aq)
is closest to
(ΔG°(AgBr/Ag, Br⁻) = +0.17 V, E°(Ag/Ag⁺) = 0.80 V, F = 96500 C mol⁻¹)
1. 7 kJ mol⁻¹
2. 70 J mol⁻¹
3. 70 kJ mol⁻¹
4. 7 J mol⁻¹

61. (2,2'-बायपिरिडीन)Ni(II) के सिद्धिविरल में से जी किस प्रकार से होता है, यह है?

61. The ligand that binds strongly to the nickel centre in (2,2'-bipyridine)Ni(II) complex is?

62. विभाग I और विभाग II की तुलना का क्षेत्र को दिखाएं:

62. Match the items given in Column I with those given in Column II:

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Magic number</td>
<td>i. Nuclear fusion</td>
</tr>
<tr>
<td>b. Liquid drop model of nucleus</td>
<td>ii. Q-value</td>
</tr>
<tr>
<td>c. Actinides</td>
<td>iii. Radioactivity</td>
</tr>
<tr>
<td>d. Threshold energy</td>
<td>iv. Shell model of nucleus</td>
</tr>
</tbody>
</table>
The correct match is:
1. $a = 2v; b = 1; c = 1v; d = 0$
2. $a = 1; b = 1v; c = 1v; d = 2$
3. $a = 1v; b = 1v; c = 1v; d = 4$
4. $a = 1v; b = 1v; c = 1v; d = 4$

63. The cluster type and geometry of the species $[\text{Rh}P(CO)\text{Ph}]^+$ are:
1. close, tricapped trigonal prism
2. dentic, trigonal prism
3. nido, capped square antiprism
4. nido, bicapped trigonal prism

64. 1-Propane and $[\text{H}_{3}C\text{CH}_{2}\text{CO}]_{2}$ exhibit a characteristic 6-membered ring. A molecule of 1-propane is also a member of the same family. The linear hydroformylation product is formed with the highest selectivity when $L$ in the rhodium complex is 

65. The hydrocarbon having an analogous structure to that of $\text{P}_{4}\text{O}_{6}$ is:
1. $[(\text{CH})_4(\mu - \text{CH}_3)]_4$
2. $[(\text{CH})_4(\mu - \text{CH}_3)]_4$
3. $[(\text{CH})_4(\mu - \text{CH}_3)]_4$
4. $[(\text{CH})_4(\mu - \text{CH}_3)]_4$

66. The hydrocarbon having an analogous structure to that of $\text{P}_{4}\text{O}_{6}$ is:
1. $[(\text{CH})_4(\mu - \text{CH}_3)]_4$
2. $[(\text{CH})_4(\mu - \text{CH}_3)]_4$
3. $[(\text{CH})_4(\mu - \text{CH}_3)]_4$
4. $[(\text{CH})_4(\mu - \text{CH}_3)]_4$

67. The hydrocarbon having an analogous structure to that of $\text{P}_{4}\text{O}_{6}$ is:
1. $[(\text{CH})_4(\mu - \text{CH}_3)]_4$
2. $[(\text{CH})_4(\mu - \text{CH}_3)]_4$
3. $[(\text{CH})_4(\mu - \text{CH}_3)]_4$
4. $[(\text{CH})_4(\mu - \text{CH}_3)]_4$

68. The hydrocarbon having an analogous structure to that of $\text{P}_{4}\text{O}_{6}$ is:
1. $[(\text{CH})_4(\mu - \text{CH}_3)]_4$
2. $[(\text{CH})_4(\mu - \text{CH}_3)]_4$
3. $[(\text{CH})_4(\mu - \text{CH}_3)]_4$
4. $[(\text{CH})_4(\mu - \text{CH}_3)]_4$
66. Match the items given below in the three columns:

<table>
<thead>
<tr>
<th>Metallo-protein</th>
<th>Species coordinated to metal centre(s)</th>
<th>Resonance Raman O–O stretching frequency (cm⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Hemoglobin</td>
<td>I. $\eta^+\eta^2\cdot O_2$ X. 844</td>
<td></td>
</tr>
<tr>
<td>B. Oxygen-</td>
<td>II. $\eta$ $\cdot$HO $\cdot$ V. 803</td>
<td></td>
</tr>
<tr>
<td>C. Oxygen-</td>
<td>III. $\eta^2\cdot O_2$ Z. 1105</td>
<td></td>
</tr>
</tbody>
</table>

Correct matches:
1. A-II-X; B-I-Y; C-I-X
2. A-II-Y; B-I-X; C-I-X
3. A-II-Y; B-I-X; C-I-X
4. A-I-X; B-II-Y; C-II-Z

67. नाफ़ Fe(EDTA) (H₂O)₄ (X) का एक तम्बूम तापमान (को) प्राप्त करने में 120°C पर 5.6 % की संख्यक आधार दर्शाता है। इस आधार के परिक्रमण के तब संकुचन का प्रभाव पाया जा चुका।

1. NaFe(EDTA)(H₂O)₄
2. NaFe(EDTA)²⁺
3. NaFe(EDTA)(H₂O)₂
4. NaFe(EDTA)(H₂O)₄

68. तंत्रामूर्ति के दो शेष के संबंध पर विचार कीजिए।

- सेट A: [AlF₄]³⁻, [PBr₅], [SiF₄]²⁻ तथा [SF₆]²⁻
- सेट B: [Ba(H₂O)₄]²⁺, [Ca(H₂O)₄]²⁺, [Mg(H₂O)₄]²⁺, [Si(H₂O)₄]²⁻

69. Consider the following statements for Eu²⁺:

a. The positions of sharp bands in UV-vis spectra of its complexes depend heavily on the ligand environment.

b. Its ground state term symbol is $^4$F₉/₂.

c. The observed magnetic moment is due to populations higher level.

d. At 2 K its magnetic moment approaches to zero.

The set of correct statements is:

1. a, c and e
2. b, c and d
3. a, b and d
4. a, b and c
70. The product for the reaction given below is

1. Me₅P \( \text{Cl} \)
2. H
3. Me₅P
4. Cl

71. The \( ^{13}P\{^14}H \) NMR spectrum of cis-IP(PE₃\text{H}_{2}\text{Cl})_2\text{Cl} \) (99.9% abundance) \( J = \frac{1}{2} \); its other isotores are NMR inactive; \( ^{31}P : J = \frac{1}{4} \) is comprised with satellite peaks of a
1. triplet 2. singlet 3. doublet 4. quartet

72. The correct order of intensity of the d-d transitions in the complexes of a 3d transition metal ion \( M^2+ \) is
1. cis-[M(H₂O)₅Cl₂] > trans-[M(H₂O)₅Cl₂] > [M(H₂O)₆]²⁺
2. [M(H₂O)₅Cl] > cis-[M(H₂O)₅Cl] > trans-[M(H₂O)₅Cl] > [M(H₂O)₆]²⁺
3. \( \text{trans-}[\text{M}(	ext{H}_2\text{O})_2\text{Cl}_2] > \text{cis-}[\text{M}(	ext{H}_2\text{O})_2\text{Cl}_2] > [\text{M}(	ext{H}_2\text{O})]^+ \)

4. \( [\text{M}(	ext{H}_2\text{O})]^+ > \text{cis-}[\text{M}(	ext{H}_2\text{O})_2\text{Cl}_2] > \text{trans-}[\text{M}(	ext{H}_2\text{O})_2\text{Cl}_2] \)

73. The reaction of decathorben B_{10}H_{14} with acetylene in the presence of BEOS gives:
1. C.B_{10}H_{12}
2. C.B_{10}H_{12}
3. C.B_{10}H_{12}
4. C.B_{10}H_{12}

74. In compound NaP_{2}F_{6}, the geometry around nitrogen and phosphorus, respectively, are:
1. pyramidal and tetrahedral
2. planar and tetrahedral
3. pyramidal and planar
4. planar and trigonal bipyramidal

75. A reaction in 2c-2e bonds (x) of a molecule is related to 'N' (valence electrons) and 'n' (skeletal atoms) by \( x = (8n-N)/2 \) (where 'n' is the number of skeletal atoms). For P_{2}S_{5}, the values of 'x' and 'n' are:
1. \( x = 38, 9 \) and \( n = 5 \), respectively
2. \( x = 38, 9 \) and \( n = 5 \), respectively
3. \( x = 38, 9 \) and \( n = 5 \), respectively
4. \( x = 38, 9 \) and \( n = 5 \), respectively

76. Match the following complexes with their \( v_{\text{C=O}} \) stretching frequencies:

<table>
<thead>
<tr>
<th>Complex</th>
<th>( v_{\text{C=O}}(\text{cm}^{-1}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) [\text{Mo}^{3+}(\text{CO})_6]</td>
<td>(i) 1935, 1934</td>
</tr>
<tr>
<td>(b) [\text{Mo}^{6+}(\text{CO})_6]</td>
<td>(ii) 1888, 1977</td>
</tr>
<tr>
<td>(c) [\text{Mo}^{5+}(\text{CO})_6]</td>
<td>(iii) 2055, 2090</td>
</tr>
<tr>
<td>(d) [\text{Mo}^{4+}(\text{CO})_6]</td>
<td>(iv) 1746, 1888</td>
</tr>
</tbody>
</table>

The correct match is:
1. a - i; b - ii; c - iii; d - iv
2. a - ii; b - i; c - iv; d - iii
3. a - iii; b - ii; c - iv; d - i
4. a - i; b - ii; c - iv; d - iii

77. For the complex \([\text{Fe}^3\text{CN}]^{4-}\) (A) and \([\text{Fe}^3\text{CN}]^{4-}\) (B) with \([\text{Cr}^3\text{CO}]^{3+}\) (C) and \([\text{Cr}^3\text{CO}]^{3+}\) (D) are compared below. The pair with correct order is:
1. A>B; C>D
2. A>B; B>C
3. A>B; C>D
4. A>B; C>D

78. The values of \( v_{\text{C=O}} \) in \([\text{Fe}^3\text{CN}]^{4-}\) (A) and \([\text{Fe}^3\text{CN}]^{4-}\) (B) and \( v_{\text{C=O}} \) in \([\text{Cr}^3\text{CO}]^{3+}\) (C) and \([\text{Cr}^3\text{CO}]^{3+}\) (D) are compared below. The pair with correct order is:
1. A>B; C>D
2. A>B; C>D
3. A>B; C>D
4. A>B; C>D

80. For the complexes \([\text{Fe}^3\text{CN}]^{4-}\) and \([\text{Fe}^3\text{CN}]^{4-}\), the following reactions are shown:
1. A lasting 0-14 days is a light reaction
2. The light reaction in \([\text{Fe}^3\text{CN}]^{4-}\) is a dark reaction
3. All of the above reactions are light reactions
4. Of the above reactions, only one is a light reaction

78. Consider the following statements for FeCl₃:
   a. It is stable in the pH range 0-4.
   b. It is stable in strongly basic medium only.
   c. It is a very strong oxidizing agent.
   d. The isomer shift in its Mössbauer spectrum is more negative compared to that of FeCl₄⁻.

   The correct statements are:
   1. a, c, and d
   2. b, c, and d
   3. b, c, and d (Corrected)
   4. c and d

79. The isomers A and B undergo base hydrolysis by forming a trigonal bipyramidal intermediate. The correct statement is:

80. B₃H₃₄ reacts with:
   a. water to give boric acid and H₂
   b. oxygen to give B₂O₃ and H₂O
   c. water to give boric acid and H₂O⁻
   d. oxygen to give B₂O₃ and H₂O

   Correct statements from the above are:
   1. a and b
   2. a and d
   3. b and c
   4. b and d

81. Na₂O₄ is used in soap making for:
   a. the sodium salt of fatty acids with 1,2-dioleoyl-1,2-dioleoyl-3-aminophosphonate-2-amine
   b. the sodium salt of fatty acids with 1,2-dioleoyl-1,2-dioleoyl-3-aminophosphonate-2-amine
   c. the sodium salt of fatty acids with 1,2-dioleoyl-1,2-dioleoyl-3-aminophosphonate
   d. the sodium salt of fatty acids with 1,2-dioleoyl-1,2-dioleoyl-3-aminophosphonate

82. Both 1-chloro-1-phenylpropan-2-one and 1-chloro-1-phenylpropan-2-one give same product A when heated in the presence of Na₂O₄. The product A is:
   1. methyl 1-phenylpropanoate
   2. hydroxy-2-phenylpropanoate
   3. methyl 1-phenylpropanoate
   4. 1-hydroxy-2-phenylpropanoate

83. The following reactions in a balanced manner:

   \[
   \text{Na}_2\text{O}_4 + \text{CO}_2 \rightarrow \text{Na}_2\text{CO}_3 + \text{O}_2
   \]

   \[
   \text{Na}_2\text{O}_4 + \text{H}_2\text{O} \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O}
   \]
82. The major product formed in the following reaction sequence is

83. The major product formed in the following reaction is

84. The compound has the following structural formula:

85. The compound reacts with the following reagent to form products A and B:

For 84:

- **A** is: 
- **B** is: 

For 85:

- **A** is: 
- **B** is: 

1-5-8
84. The structures of products A and B formed in the Edman degradation of the dipetide are:

85. Partial spectroscopic data is given below for an organic compound:
   i. 4 signals between 8 120-130 ppm in $^{13}$C NMR spectrum
   ii. 2 doublets between 8 6.8-8.5 ppm in $^1H$ NMR spectrum
   iii. an absorption band at 1724 cm$^{-1}$ in IR spectrum

The structure of the compound is:

86. एक कार्बनिक वायुक के आसिक स्पेक्ट्रम में आयाम हैं:
   i. $^{13}$C NMR स्पेक्ट्रम में 8 120-130 ppm के लिए 4 सिग्नल
   ii. $^1H$ NMR स्पेक्ट्रम में 8 6.8-8.5 ppm के लिए 2 द्विगत
   iii. IR स्पेक्ट्रम में 1724 cm$^{-1}$ पर एक आवश्यक बंधक संरचना है:

The major product formed in the following reaction is:

1. m-CPBA (1 equiv.)
2. Ac$_2$O
3. aq. Na$_2$CO$_3$
87. The major products A and B in the following reaction sequence are

88. The compound P undergoes a pericyclic reaction under photochemical conditions to give compound Q. In compound Q, the relative stereochemistry and 'H NMR chemical shift values of methyl groups (in ppm), respectively, are

89. The product of the reaction with m-CPBA is B.
89. The major products A and B in the following reaction sequence are

\[
\text{O} \xrightarrow{\text{Cl}_2\text{CCOCIO}} \text{A} \xrightarrow{\text{m-CPBA}} \text{B}
\]

90. The major product formed in the following reaction is

\[
\text{SiMe}_3 \xrightarrow{\text{i-n-Bu}_4\text{NF}} \xrightarrow{\text{MeO}_2\text{C} \xrightarrow{\text{CO}_2\text{Me}}}
\]

91. Structure of the compound displaying following characteristic spectral data

IR: 1720 cm\(^{-1}\)

\(^1\)H NMR: 6.2 (br s, 1H), 5.5 (br s, 1H), 4.2 (q, 2H), 2.0 (s, 3H), 1.1 (t, 3H)
92. The major product formed in the following reaction is

\[
\text{CH}_3\text{CO}_2\text{H} + \text{MgCl} \quad (2 \text{ equiv.}) \quad \overset{(\text{t-PrO})_2\text{Ti}}{20 \degree \text{C}} \quad \text{CH}_3\text{CO}_2\text{H}
\]

1. \( \text{CHO} \)
2. \( \text{CHO} \)
3. \( \text{CH}_3\text{CHO} \)
4. \( \text{CH}_3\text{OH} \)

93. The intermediate(s) involved in the following reaction is (are)

\[
\text{CH}_3\text{CO}_2\text{H} \quad (\text{t-PrO})_2\text{Ti} \quad 20 \degree \text{C}
\]

1. only I
2. only II
3. I and II only
4. I and III only

94. The intermediate is used in the following reaction with the help of the following reagents:

\[
\text{CH}_3\text{CO}_2\text{H} \quad \text{NaH, 1-phenyl-lactone, HCl, NaOH}
\]

1. (I) NaH, 1-phenyl-lactone, HCl, NaOH
2. (II) NaBH_4, (III) NaH, 1-phenyl-lactone, HCl

1-B-H
94. Correct sequence of reagents to be used for the following conversion is

1. (I) NaH, 1-fluoranthene; (II) NaBH₄; (III) (CH₃)₂O, Me₂NH.HCl; ii. 5 N NaOH.
2. (I) NaBH₄; (II) NaH, 1-fluoranthene; (III) i. (CH₃)₂O, Me₂NH.HCl ii. 5 N NaOH.
3. (I) i. (CH₃)₂O, Me₂NH.HCl; ii. 5 N NaOH; (II) NaBH₄; (III) NaH, 1-fluoranthene.
4. (I) i. (CH₃)₂O, Me₂NH.HCl; ii. 5 N NaOH; (II) NaBH₄.

95. विनिमयांकित अभिक्रिया में विनिमय मुद्रण उत्पन्न A लेकिन B है।

96. विनिमयांकित अभिक्रिया में विनिमय मुद्रण उत्पन्न है।

96. The major product formed in the following reaction is

1. I₂, Pyridine
2. Pd(PPh₃)₄
3. NaBH₄, GeCl₃·7H₂O

95. The major products A and B formed in the following reactions are

1. L.B.H
97. The major product formed in the following reaction is

\[
\text{O} \xrightarrow{1. \text{SmI}_2} \text{OMe} \\
2. \text{H}_{2}C=\text{CHCO}_2\text{Me}
\]

1. 
2. 
3. 
4.

98. The major product formed in the following reaction is

\[
\text{MeO} \xrightarrow{\text{PPh}_3, \text{MeI, PDC}} \text{MeO} \\
\text{KOH, PPh}_3
\]

1. 
2. 
3. 
4.
99. The major product formed in the following photochemical reaction is

100. Correct sequence of reagents to be used for the following conversion is

101. Conductivity of water and a saturated solution of a sparingly soluble salt AB₂, are 7 and 21 μS m⁻¹, respectively. Given, \( \lambda_\text{w} = 12.72 \text{ mS m}^{-1} \text{ mol}^{-1} \) and \( \lambda_{\text{solute}} = 7.64 \text{ mS m}^{-1} \text{ mol}^{-1} \), the solubility of AB₂, in mol m⁻³, is

1. \( 5.0 \times 10^{-4} \)  
2. \( 5.0 \times 10^{-3} \)  
3. \( 5.0 \times 10^{-5} \)  
4. \( 5.0 \times 10^{-6} \)
102. The equilibrium constant of the following reaction
\[ \text{Sn}(s) + \text{Sn}^{3+}(aq) \rightleftharpoons 2 \text{Sn}^{2+}(aq) \] at 300 K is close to
\[ K_c = 9.64 \times 10^{-6} \text{ mol}^{-2} \text{ L}^2 \text{ mol}^2 \]
\[ V \cdot R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1} \cdot F = 96485 \text{ C mol}^{-1} \]
1. \( 10^{-7} \) 2. \( 10^{-6} \) 3. \( 10^{-5} \) 4. \( 10^{-9} \)

103. The equilibrium constant of the following reaction
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1. \( 10^{-7} \) 2. \( 10^{-6} \) 3. \( 10^{-5} \) 4. \( 10^{-9} \)

104. The angle \( \theta \) is the angle of the equator.
1. \( \frac{\rho}{\lambda} \) 2. \( \frac{\rho}{\lambda} \) 3. \( \frac{\rho}{\lambda} \) 4. \( \frac{\rho}{\lambda} \)

105. The entropy of a perfect gas is
1. independent of \( V \) 2. proportional to \( V \) 3. proportional to \( \ln V \) 4. proportional to \( V^2 \)

106. The free energy \( G \) of a system with 10 non-interacting spins \( S = 1 \) is
1. \( -k_B T \ln(3) \) 2. \( -10k_B T \ln(3) \) 3. \( -10k_B T \ln(0.3) \) 4. \( -10k_B T \ln(0.3) \)
107. The $\chi$-orbital of ethylene, when placed in the $xy$-plane with the $C - C$ bond aligned to the $x$-axis, transforms according to the irreducible representation (Use Table 1).
1. $a_u$
2. $b_2$
3. $b_1$
4. $b_3$

108. The $h_u \rightarrow b_2$ transition in ethylene is not allowed.
1. not allowed.
2. allowed by $y$-polarized light.
3. allowed by $y$-polarized light.
4. allowed by $z$-polarized light. (Use Table 1)

109. The $h_u \rightarrow b_2$ transition in ethylene is not allowed.
1. not allowed.
2. allowed by $z$-polarized light.
3. allowed by $y$-polarized light.
4. allowed by $z$-polarized light. (Use Table 1)

110. $k_\text{M}$ is the effective first-order rate constant of the following unimolecular reaction:

$$A + M \stackrel{k_1}{\rightarrow} A^* + M$$

111. The slope and intercept of the plot of $1/k_\text{M}$ vs. $[1/M]$ are $4 \times 10^6$ and $8 \times 10^4$, respectively. The value of $k_1/k_2$ is:
1. $2 \times 10^4$
2. $2 \times 10^5$
3. $2 \times 10^6$
4. $2 \times 10^7$

112. 

$O_3 \stackrel{k_1}{\rightarrow} O_2 + O$

$O_3 \rightarrow O_2$ + $O$

$O_3 \stackrel{k_2}{\rightarrow} 2O_2$

The value of $k_1/k_2$ is:
1. $2 \times 10^4$
2. $2 \times 10^5$
3. $2 \times 10^6$
4. $2 \times 10^7$

113. $O_3$ is the effective first-order rate constant of the following unimolecular reaction:

$$A + M \stackrel{k_1}{\rightarrow} A^* + M$$

The slope and intercept of the plot of $1/k_\text{M}$ vs. $[1/M]$ are $4 \times 10^6$ and $8 \times 10^4$, respectively. The value of $k_1/k_2$ is:
1. $2 \times 10^4$
2. $2 \times 10^5$
3. $2 \times 10^6$
4. $2 \times 10^7$

114. 

$O_3 \stackrel{k_1}{\rightarrow} O_2 + O$

$O_3 \rightarrow O_2$ + $O$

$O_3 \stackrel{k_2}{\rightarrow} 2O_2$

The value of $k_1/k_2$ is:
1. $2 \times 10^4$
2. $2 \times 10^5$
3. $2 \times 10^6$
4. $2 \times 10^7$
111. The decomposition mechanism of ozone is
\[ \text{O}_3 \xrightarrow{k_1} \text{O}_2 + \text{O} \]
\[ \text{O}_3 + \text{O} \xrightarrow{k_2} 2\text{O}_2 \]

If \( k_1 [\text{O}_3] \ll k_2 [\text{O}] \), then the order of the reaction with respect to ozone is
1. zero
2. one
3. two
4. complex

112. Arrange the following molecules in order of increasing fundamental vibrational frequencies:
1. \( \text{O}_2 \) \( < \) \( \text{H}_2 \text{O} \) \( < \) \( \text{CO}_2 \)
2. \( \text{O}_2 \) \( < \) \( \text{H}_2 \text{O} \) \( < \) \( \text{CO}_2 \)
3. \( \text{O}_2 \) \( < \) \( \text{H}_2 \text{O} \) \( < \) \( \text{CO}_2 \)
4. \( \text{O}_2 \) \( < \) \( \text{H}_2 \text{O} \) \( < \) \( \text{CO}_2 \)

113. The study of electronic absorption spectra in terms of the empirical vibrational analysis reveals that the potentials \( \alpha \) and \( \beta \) are given by:
1. \( \alpha = 1.62 \beta \)
2. \( \alpha = 0.62 \beta \)
3. \( \alpha = -0.62 \beta \)
4. \( \alpha = -1.62 \beta \)

114. Structure of the molecule is:
1. Linear symmetrical (\( D_{\infty h} \))
2. Bent symmetrical (\( C_{3v} \))
3. Linear asymmetrical (\( C_{2v} \))
4. Bent asymmetrical (\( C_{2} \))

115. For a one-dimensional (\( x \)) harmonic oscillator perturbed by an \( x' \) potential, the sum of the first order and second order corrections to the ground state energy is:
1. \( < 0 \)
2. \( > 0 \)
3. \( > 0 \)
4. \( \geq 0 \)
116. The per cent of a total of 350 cases in which the patient had the disease was 20%. Calculate the number of cases that had the disease.

117. If the probability of drawing a red card from a standard deck of 52 cards is 1/2, what is the probability of drawing a black card?

118. A company plans to build a new factory on a site that is 5 acres in size. The cost of land is $100 per square foot. The building cost is $200 per square foot. The total area required for the factory is 20,000 square feet. Calculate the total cost of the project.

119. Consider a system where the temperature increases from 0 K to 100 K. Calculate the change in entropy.

120. The third and fourth lines in the rotational spectrum of CO are separated by 8 cm⁻¹. The CO bond length is given by:
FOR ROUGH WORK