Scier	nceX
Educ	ation

National Level ScienceX Olympiads

ScienceX Chemistry Olympiad (SCO)

Name:			
Date:			

Exam ID: 103

Exam Instructions

- 1. The timer has been set for the exam, and a countdown will display the remaining time. When the timer runs out, the exam will end automatically. No further action will be required after that.
- 2. You can flag any question that you want.
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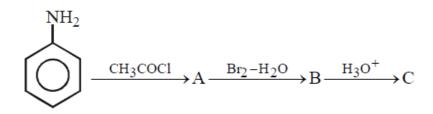
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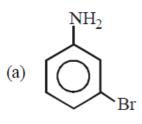
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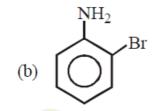
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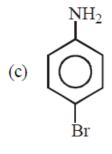
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C (major product) is -







(d) None of these

Please mark (\checkmark) for the correct answer.

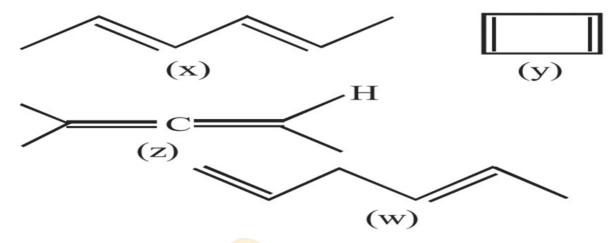
(b)

O B. (a)

O. (d)

D. (c)

The correct stability order of following species is



Please mark (\checkmark) for the correct answer.

- \bigcirc A. x > y > w > z
 - **C.** x > w > z > y

- **B.** z > x > y > w
- **D.** y > x > w > z

Question: 3 of 50 QID: 231 Marks: 4 Nitrogen in an organic compound can be estimated by Please mark (\checkmark) for the correct answer. A. Neither (a) nor (b) B. Both (a) and (b) C. Duma's method only **D.** Kjeldahl's method only

QID: 213 Marks: 4 Question: 4 of 50

Assertion: The molecules of the dissolved gas present in a liquid gain kinetic energy as temperature is raised.

Reason: Gases tends to be more soluble in liquids as the temperature is raised

Please mark (\checkmark) for the correct answer.

- () A. If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
 - **C.** If both the Assertion and Reason are incorrect.
- () **B.** If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
- **D.** If Assertion is correct but Reason is incorrect.

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Question: 5 of 50	QID: 218	Marks: 4
Assertion: Sn ⁴⁺ compounds are stronger oxidizing ager	nts than Pb	⁴⁺ compounds.
Reason: The higher oxidation states for the group 14 el due to 'inert pair effect'.	ements are	e more stable for the heavier members of the group
Please mark (✓) for the correct answer.		
A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.	○ В.	If Assertion is correct but Reason is incorrect.
C. If both the Assertion and Reason are incorrect.	O D.	If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
Question: 6 of 50	QID: 230	Marks: 4
Which of the following structure is similar to graphite?		
Please mark (✓) for the correct answer.		
A. BN	○ В.	B_2H_6
○ c. B ₄ C	O D.	В
Question: 7 of 50	QID: 250	Marks: 4
Electron affinity of sulphur is		
Please mark (✓) for the correct answer.		
A. less than O but more than Se	○ В.	equal to O and Se
C. more than O but less than Se	O D.	more than O and Se
Question: 8 of 50	QID: 229	Marks: 4
A compound X, of boron reacts with NH_3 on heating to go The compound X can be prepared by treating BF_3 with lit represented by the formulas.		
Please mark (\checkmark) for the correct answer.		
\bigcirc A. B ₂ H ₆ , B ₃ N ₃ H ₆	О В.	B ₃ N ₃ H ₆ , B ₂ H ₆

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 \bigcirc **D.** B₂O₃, B₃N₃H₆

 \bigcirc **c.** BF₃, B₃N₃H₆

Question: 9 of 50	QID: 239	Marks: 4
If salt bridge is removed from two half-cells the voltage	e	
Please mark (✓) for the correct answer.		
▲ increases gradually	○ B. does not change	
C. drops to zero	O. increases rapidly	
Question: 10 of 50	QID: 207	Marks: 4
A gas cylinder with cooling gas inside can sustain pres gauge reads 12 atmospheres. The temperature rises at the following temperature:		
Please mark (\checkmark) for the correct answer.		
○ A. 87.5°C	○ B. 115.5°C	
○ C. 99.5°C	○ D. 135.5°C	
Question: 11 of 50	QID: 240	Marks: 4
What is the activation energy for a reaction if its rate $(R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1})$ Please mark (\checkmark) for the correct answer. A. 342 kJ mol ⁻¹ C. 34.7 kJ mol ⁻¹	B. 15.1 kJ mol ⁻¹ D. 269 kJ mol ⁻¹	om 20°C to 35°C?
Question: 12 of 50	QID: 236	Marks: 4
Blood cells retain their normal shape in solution which	are	
Please mark (✓) for the correct answer.		
A. isotonic to blood	B. equinormal to blood.	
C. hypertonic to blood	O. hypotonic to blood	
Question: 13 of 50	QID: 219	Marks: 4
Which of these does not happen when a moderate an	ount of sodium metal dissolves in liquid N	NH ₃ at a low temperature?
Please mark (\checkmark) for the correct answer.		
A. A blue-coloured solution is produced.	B. Liquid ammonia maintains	its diamagnetic properties
C. Na ⁺ ions start to form in the mixture.	D. Liquid NH ₃ becomes an ef conductor.	fective electrical

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Question: 14 of 50	QID: 246	Marks
Which of the following statements is correct	ct ?	
Please mark (✓) for the correct answer.		
A. Fluxes are carefully chosen to comgangue present in the ore to prod slag to carry away the impurities	\sim	Gangues are carefully chosen to combine with the slag present in the ore to produce easily fusible flu to carry away the impurities
C. Slags are carefully chosen to comb present in the ore to produce easil to carry away the impurities		Gangues are carefully chosen to combine with the flux present in the ore to produce easily fusible sla to carry away the impurities
Question: 15 of 50	QID: 215	Marks
The pH of solution containing 0.10 M sodiu	m acetate and 0.03 M a	cetic acid is (pKa for CH ₃ COOH = 4.57)
Please mark (✓) for the correct answer.		
A. 6.09	О В	. 4.09
C. 7.09	(D	o. 5.09
The first ionization energies of alkaline eart Please mark (/) for the correct answer.	in metals are nighter than	Titlose of alkali metals. This is because
A. there is increase in the nuclear cha	arge of alkaline	• there is no change in the nuclear charge
		there is no change in the nuclear charge none of these
 A. there is increase in the nuclear character metals C. there is decrease in the nuclear character in t		
A. there is increase in the nuclear character metals C. there is decrease in the nuclear character metals Question: 17 of 50	arge of alkaline D	o. none of these
 A. there is increase in the nuclear character metals C. there is decrease in the nuclear character metals 	arge of alkaline D	o. none of these
A. there is increase in the nuclear character metals C. there is decrease in the nuclear character metals Question: 17 of 50 Out of the following statements, which state	QID: 214 tement is incorrect?	o. none of these

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B. (i), (ii) and (iii)

D. (i) and (iii)

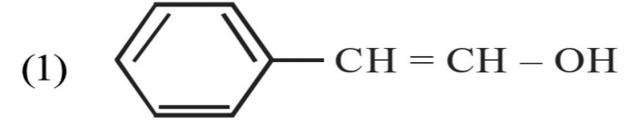
A. (ii) and (iv)

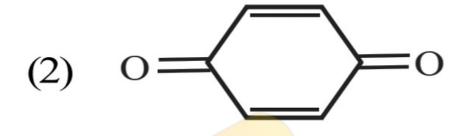
C. (i), (ii) and (iv)

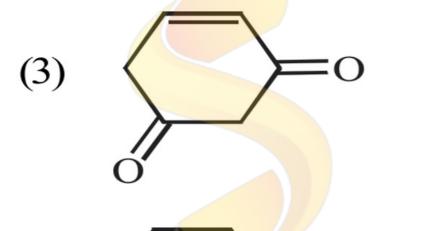


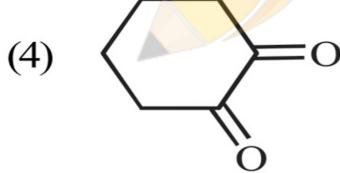
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Tautomerism is exhibited by









Please mark (\checkmark) for the correct answer.

- **A.** (2), (3), and (4)
- C. None of these

- B. All of these
- **D.** (1), (3) and (4)

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The bromination of acetone that occurs in acid solution is represented by this equation. $CH_3COCH_3(aq) + Br_2(aq) \rightarrow CH_3COCH_2Br(aq) + H^+(aq) + Br^-(aq)$

These kinetic data were obtained for given reaction concentrations.

Initial			Initial rate,
Concentrations,	M		disappearance of
			$\mathrm{Br}_2,\mathrm{Ms}^{-1}$
[CH ₃ COCH ₃]	$[Br_2]$	$[\mathbf{H}^+]$	
0.30	0.05	0.05	5.7×10^{-5}
0.30	0.10	0.05	5.7×10^{-5}
0.30	0.10	0.10	1.2×10^{-4}
0.40	0.05	0.20	3.1×10^{-4}

Based on given data, the rate equations is:

Please mark (✓) for the correct answer.

A. Rate = $k [CH_3COCH_3][Br_2]$

- **B.** Rate = $k [CH_3COCH_3][Br_2] [H^+]$
- O. Rate = k [CH₃COCH₃] [Br₂] [H⁺]²
- **D.** Rate = $k[CH_3COCH_3][H^+]$

Question: 28 of 50
QID: 220
Marks: 4

Select correct statement(s).

- (i) Cyanamide ion (CN_2^{2-}) is isoelectronic with CO_2 and has the same linear structure.
- (ii) Mg₂C₃ reacts with water to form propyne
- (iii) CaC₂ has NaCl type lattice.
- (iv) Chemically borax is sodium tetraborate decahydrate

Please mark (\checkmark) for the correct answer.

A. (i), (ii) and (iii)

B. (i), (ii), (iii) and (iv)

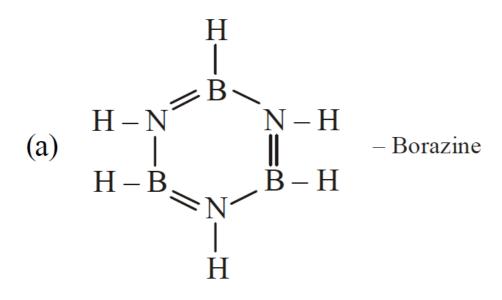
C. (i) and(ii)

D. (i) and (iii)

Question: 29 of 50 QID: 228 Marks: 4

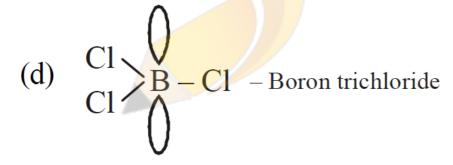
Which of the following compounds is not matched correctly with its structure?

Marks: 4



(b)
$$H > B > H - Diborane$$

(c)
$$Cl$$
 Al Cl Cl - Aluminium chloride



Please mark (\checkmark) for the correct answer.

A. (b)

B. (c)

C. (d)

D. (a)

Question: 30 of 50

QID: 247

Larger number of oxidation states are exhibited by the actinoids than those by the lanthanoids, the main reason being

Please mark () for the correct answer.

- **A.** 4f orbitals more diffused than the 5f orbitals
- **B.** more energy difference between 5f and 6d than between 4f and 5d orbitals
- C. more reactive nature of the actionids than the lanthanoids
- **D.** lesser energy difference between 5f and 6d than between 4f and 5d orbitals

Marks: 4

The end product (C) in the following sequence of reactions is

$$HC \equiv CH \xrightarrow{1\% \text{HgSO}_4} A \xrightarrow{CH_3\text{MgX}} B \xrightarrow{[O]} (C)$$

Please mark (\checkmark) for the correct answer.

A. ethanol

B. acetone

C. acetic acid

D. isopropyl alcohol

Question: 32 of 50 QID: 233 Marks: 4

Which of the following statement(s) is/are correct?

- (i) Classical smog is a mixture of smoke, fog and sulphur dioxide.
- (ii) Classical smog is also called oxidising smog
- (iii) Hydrocarbons, NO2 and PAN are components of photochemical smog.

Please mark (✓) for the correct answer.

A. (i), (ii) and (iii)

B. (i) and (iii)

C. (iii) only

D. (i) and (ii)

Question: 33 of 50QID: 238

Marks: 4

 E° of a cell $aA + bB \longrightarrow cC + dD$ is

(a)
$$E + RT \ln \frac{[a]^A [b]^B}{[c]^C [d]^D}$$
 (b) $E + \frac{RT}{nF} \ln \frac{[C]^c [D]^d}{[A]^a [B]^b}$

(c)
$$E + \frac{RT}{nF} \ln \frac{[C]^{c}[d]^{D}}{[A]^{A}[B]^{B}}$$
 (d) $E + \frac{RT}{nF} \ln \frac{[a]^{A}[B]^{B}}{[C]^{C}[d]^{D}}$

Please mark (✓) for the correct answer.

(c)

(b)

O. (a)

D. (d)

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Question: 38 of 50	QID: 251	Marks: 4
Which of the following statements are correct? (i) As a result of lanthanoid contraction members of (ii) IE ₂ is high for Cr and Cu whereas IE ₃ is very high (iii) Heavier members of d-block elements like p-block (iv) In any transition series maximum number of oximiddle elements.	h for Zn.	s near
Please mark (\checkmark) for the correct answer.		
A. (i), (ii) and (iv)	B. (i) and (ii)	
C. (i), (ii) and (iii)	O. (ii) and (iv)	
Question: 39 of 50	QID: 242	Marks: 4
The adsorption of a gas on a solid surface varies with pr	ressure of the gas in which of the following manner	
Please mark (\checkmark) for the correct answer.		
A. Slow →fast → independent of the pressure	\bigcirc B. Independent of the pressure \rightarrow slow \rightarrow for the pressure \rightarrow slow \rightarrow slow \rightarrow for the pressure \rightarrow slow	ast
\bigcirc C. Fast \rightarrow slow \rightarrow independent of the pressure	\bigcirc D. Independent of the pressure \rightarrow fast \rightarrow sl	ow
Question: 40 of 50	QID: 248	Marks: 4
In nitrogen family, the H-M-H bond angle in the hydrides shows that gradually	gradually becomes closer to 90° on going from N to S	b. This
Please mark (✓) for the correct answer.		
A. The basic strength of the hydrides increases	○ B. Almost pure p-orbitals are used for M-H	bonding
C. The bond energies of M-H bonds increase	O. The bond pairs of electrons become near	er to the

central atom

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Match List – I with List –II for the compositions of substances and select the correct answer using the code given below the lists

List - I Substances

(A) Plaster of paris

- (B) Epsomite
- (C) Kieserite
- (D) Gypsum

List - II

Composition

- (i) $CaSO_4.2H_2O$
- (ii) $CaSO_4$. $\frac{1}{2}H_2O$
- (iii) $MaSO_4.7 H_2O$
- (iv) $MgSO_4$. H_2O

Please mark (✓) for the correct answer.

- - **C.** (A) \rightarrow (ii), (B) \rightarrow (iii), (C) \rightarrow (i), (D) \rightarrow (iv)

Question: 42 of 50

QID: 253

Marks: 4

The IUPAC name of the complex [Co(NH₃)₄(H₂O)Cl]Cl₂ is

Please mark (✓) for the correct answer.

A. aquatetramminechloridocobalt (III) chloride

C. tetrammineaquachloridocobalt (III) chloride

D. chloridoaquatetramminechloridocobalt (III) chloride

Question: 43 of 50 QID: 235 Marks: 4

Which of the following sequence of T and F is true for given statements. Here T stands for true statement and F stands for false statement?

- (i) Frenkel defect results in increase in density of the solid.
- (ii) ZnS, AgCl, AgBr and AgI shows Frenkel defect.
- (iii) Schottky defect results in decrease in density of the solid.
- (iv) AgBr shows Schottky defect only.
- (v) For NaCl there is one Schottky defect per 10^{16} ions.

Please mark (\checkmark) for the correct answer.

A. FTTFT

B. TTTF

C. TTTFF

O. FTTFF

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Question: 44 of 50	QID: 217		Marks: 4
Identify the incorrect statement			
Please mark (✓) for the correct answer.			
A. Water gas is produced by passing steam over he coke.	ot OB.	Dry ice evaporates at -78°C without melti	ng.
$igcup {\textbf{C.}}$ Producer gas is a mixture of CO and N2.	O D.	Bell metal is an alloy of Cu and Zn	
Question: 45 of 50	QID: 227		Marks: 4
Which of the following on thermal decomposition yields a	basic as w	ell as acidic oxide ?	
Please mark (✓) for the correct answer.			
○ A. CaCO ₃	○ В.	NaNO ₃	
C. NH ₄ NO ₃	O D.	KCIO ₃	
Question: 46 of 50	QID: 244		Marks: 4
Which of the following does not contain a hydrophobic st	ructure ?		
Please mark (✓) for the correct answer.			
A. Lanolin	○ В.	Rubber	
C. Glycogen	O D.	Linseed oil	
Question: 47 of 50	QID: 234		Marks: 4
Assertion: Suspended particulate matter (SPM) is an im	portant po	llutant released by diesel vehicles.	
Reason: Catalytic converters greatly reduce pollution ca	used by au	tomobiles.	
Please mark (✓) for the correct answer.			
A. Assertion is correct, reason is correct; reason is not a correct explanation for assertion	○ В.	Assertion is incorrect, reason is correct	
C. Assertion is correct, reason is correct; reason is correct explanation for assertion.	a (D.	Assertion is correct, reason is incorrect	
Question: 48 of 50	QID: 206		Marks: 4
Out of the following statements regarding ionization pote	ential, which	one is true?	
Please mark (✓) for the correct answer.			
○ A. It decreases with an increase in atomic radii	○ В.	It is independent of atomic radii	
C. It increases with an increase in atomic radii	O D.	It remains constant with change in atomic	radii

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Question: 49 of 50	QID: 232	Marks: 4
for false statement (i) The more the number of contributing (ii) The resonance structures have differ	ad F is correct for given statements. Here T stands for a structures, the more is the resonance energy. The rent positions of nuclei but same number of unpaired e e molecule (the resonance hybrid) is lower than that of	electrons
Please mark (\checkmark) for the correct answer.		
A. FFF	OB. TFF	
○ C. TTT	O. TFT	

Question: 50 of 50	QID: 237	Marks: 4
	eal solution containing 1 mole of liquid A and 2 moles creases by 25 mm of Hg, if one more mole of B is ac essure of A in its pure state is	
Please mark (✓) for the correct answer.		
A. 400 mm of Hg	○ B. 300 mm of Hg	
○ C. 600 mm of Hg	D. 500 mm of Hg	

--- END OF QUESTION PAPER ---

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National Level ScienceX Olympiads ScienceX Chemistry Olympiad (SCO)

Answer Key

No	Question Type	QID	Correct Answer
Question - 1	Multiple Choice (Radiobutton)	254	D
Question - 2	Multiple Choice (Radiobutton)	222	С
Question - 3	Multiple Choice (Radiobutton)	231	В
Question - 4	Multiple Choice (Radiobutton)	213	D
Question - 5	Multiple Choice (Radiobutton)	218	С
Question - 6	Multiple Choice (Radiobutton)	230	A
Question - 7	Multiple Choice (Radiobutton)	250	D
Question - 8	Multiple Choice (Radiobutton)	229	A
Question - 9	Multiple Choice (Radiobutton)	239	С
Question - 10	Multiple Choice (Radiobutton)	207	С
Question - 11	Multiple Choice (Radiobutton)	240	С
Question - 12	Multiple Choice (Radiobutton)	236	A
Question - 13	Multiple Choice (Radiobutton)	219	В
Question - 14	Multiple Choice (Radiobutton)	246	Α
Question - 15	Multiple Choice (Radiobutton)	215	D
Question - 16	Multiple Choice (Radiobutton)	225	A
Question - 17	Multiple Choice (Radiobutton)	214	В
Question - 18	Multiple Choice (Radiobutton)	210	А
Question - 19	Multiple Choice (Radiobutton)	209	С
Question - 20	Multiple Choice (Radiobutton)	245	D
Question - 21	Multiple Choice (Radiobutton)	249	D
Question - 22	Multi <mark>ple Choice (Radiobu</mark> tton)	223	D
Question - 23	Multiple Choice (Radiobutton)	243	С
Question - 24	Multiple Choice (Radiobutton)	216	D
Question - 25	Multiple Choice (Radiobutton)	252	D
Question - 26	Multiple Choice (Radiobutton)	205	D
Question - 27	Multiple Choice (Radiobutton)	241	D
Question - 28	Multiple Choice (Radiobutton)	220	В
Question - 29	Multiple Choice (Radiobutton)	228	В
Question - 30	Multiple Choice (Radiobutton)	247	D
Question - 31	Multiple Choice (Radiobutton)	221	В
Question - 32	Multiple Choice (Radiobutton)	233	В
Question - 33	Multiple Choice (Radiobutton)	238	В
Question - 34	Multiple Choice (Radiobutton)	211	А
Question - 35	Multiple Choice (Radiobutton)	224	A
Question - 36	Multiple Choice (Radiobutton)	226	A
Question - 37	Multiple Choice (Radiobutton)	208	В
Question - 38	Multiple Choice (Radiobutton)	251	A
Question - 39	Multiple Choice (Radiobutton)	242	С
Question - 40	Multiple Choice (Radiobutton)	248	В
Question - 41	Multiple Choice (Radiobutton)	212	А
Question - 42	Multiple Choice (Radiobutton)	253	С
Question - 43	Multiple Choice (Radiobutton)	235	А

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No	Question Type	QID	Correct Answer
Question - 44	Multiple Choice (Radiobutton)	217	D
Question - 45	Multiple Choice (Radiobutton)	227	A
Question - 46	Multiple Choice (Radiobutton)	244	В
Question - 47	Multiple Choice (Radiobutton)	234	A
Question - 48	Multiple Choice (Radiobutton)	206	A
Question - 49	Multiple Choice (Radiobutton)	232	D
Question - 50	Multiple Choice (Radiobutton)	237	В

--- END OF ANSWER KEY ---



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