1. If the kinetic energy of an electron is increased four times, the wavelength of the de-Broglie wave associated with it would become

(1) Two times

(2) Half

(3) One fourth

(4) Four times

Solution:

The wavelength λ is inversely proportional to the square root of kinetic energy. So if KE is increased 4 times, the wavelength becomes half.

$\lambda \propto 1/\sqrt{KE}$

Hence option (2) is the answer.

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2. The de Broglie wavelength of a car of mass 1000 kg and velocity 36 km/hr is :

(h = 6.63×10-34 Js)
(1) 6.626×10-31 m
(2) 6.626×10-34 m
(3) 6.626×10-38 m
(4) 6.626×10-30 m
Solution:
Given h = 6.63×10-34 J/s
m = 1000 kg
v = 36 km/hr = 36×103/(60×60) m/s = 10m/s
λ = h/mv
= 6.63×10-34 /1000×10
= 6.63×10-38 m
Hence option (3) is the answer.

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3. The radius of La3+ (Atomic number of La=57) is 1.06A. Which one of the following given values will be closest to the radius of Lu3+ (Atomic number of Lu = 71)?

(1) 40 A
(2) 1.06 A
(3) 0.85 A
(4) 1.60 A
Solution:
Radius, r ∝ 1/Z
r1/r2 = Z2/Z1

$1.06/r_2 = 71/57$
So $r_2 = 1.06 \times 57/71 = 0.85$
Hence option (3) is the answer.

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4. The increasing order of the ionic radii of the given isoelectronic species is?

(1) K^+, S^{2-}, Ca^{2+}, Cl^-
(2) Cl^-, Ca^{2+}, K^+,S^{2-}
(3) S^{2-}, Cl^-, Ca^{2+}, K^+
(4) Ca^{2+}, K^+, Cl^-, S^{2-}

Solution:
If the atom or molecule is negatively charged, as an additional electron occupies an outer orbital, there is increased electron-electron repulsion and increased shielding, which pushes the electrons further apart. Since the electrons now outnumber the protons in the ion, the protons cannot pull the extra electrons as tightly toward the nucleus which results in decreased Zeff. Hence, the ionic radii increase whereas it is vice versa when it is positively charged. The increasing order of the ionic radii of the given isoelectronic species is Ca^{2+}, K^+, Cl^-, S^{2-}.
Hence option (4) is the correct answer.

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5. The bond dissociation energy of B–F in BF_3 is 646 kJ mol^{-1} whereas that of C–F in CF_4 is 515 kJ mol^{-1}. The correct reason for higher B–F bond dissociation energy as compared to that of C–F is

(1) Significant pπ – pπ interaction between B and F in BF_3 whereas there is no possibility of such interaction between C and F in CF_4.
(2) Lower degree of pπ – pπ interaction between B and F in BF_3 than that
between C and F in CF_4
(3) Smaller size of B-atom as compared to that of C-atom
(4) Stronger bond between B and F in BF_3 as compared to that between C and F in CF_4.
Solution:
Because of pπ – pπ back bonding in BF_3 molecule, all B-F bonds have partial double bond character.
Hence option (1) is the answer.

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6. The ratio of masses of oxygen and nitrogen in a particular gaseous mixture is 1:4. The ratio of a number of their molecule is :

(1) 1:8
(2) 3:16
(3) 1:4
(4) 7:32
Solution:
Given the ratio of masses of oxygen and nitrogen = 1:4
Let the mass of O_2 = w
Mass of N_2 = 4w
Molecules of O_2 = $w/(32 \times N_A)$

Molecules of N_2 = 4w/(28×NA)
Ratio of number of molecules = w/(32×NA)÷4w/(28×NA)
= w/(32×NA)×(28×NA)/4w
= 7/32
So the ratio is 7:32.
Hence option (4) is the answer.

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7. The enthalpy change for a reaction does not depend on the

(a) physical states of reactants and products
(b) use of different reactants for the same product
(c) nature of intermediate reaction steps
(d) The difference in initial or final temperatures of involved substances.
Solution:
The enthalpy change for a reaction does not depend upon the nature of intermediate reaction steps. This is according to Hess's law.
Hence option (c) is the answer.

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8. The process with negative entropy change is

(a) dissolution of iodine in water
(b) sublimation of dry ice
(c) synthesis of ammonia from N_2 and H_2
(d) dissociation of $CaSO_4(s)$ to $CaO(s)$ and $SO_3(g)$.
Solution:
$N_2(g) + 3H_2 \rightarrow 2NH_3(g)$
$\Delta s = 2 - 4 = -2 < 0$
So entropy is negative.
Hence option (c) is the answer.

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9. Given : $XNa_2HAsO_3 + YNaBrO_3 + ZHCl \rightarrow NaBr + H_3AsO_4 + NaCl$

The values of X, Y and Z in the above redox reaction are respectively :
(1) 2, 1, 3
(2) 3, 1, 6
(3) 2, 1, 2
(4) 3, 1, 4

Solution:

The balanced equation is given below.
$3Na_2HAsO_3 + NaBrO_3 + 6HCl \rightarrow NaBr + 3H_3AsO_4 + 6NaCl$
The values of X, Y and Z are 3, 1 and 6 respectively.
Hence option (2) is the answer.
Given : $XNa_2HAsO_3 + YNaBrO_3 + ZHCl \rightarrow NaBr + H_3AsO_4 + NaCl$
The values of X, Y and Z in the above redox reaction are respectively :
(1) 2, 1, 3

(2) 3, 1, 6
(3) 2, 1, 2
(4) 3, 1, 4
Solution:
The balanced equation is given below.
$3Na_2HAsO_3 + NaBrO_3 + 6HCl \rightarrow NaBr + 3H_3AsO_4 + 6NaCl$
The values of X, Y and Z are 3, 1 and 6 respectively.
Hence option (2) is the answer.

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10. The correct statement for the molecule, CsI_3, is :
(1) it contains Cs^{3+} and $I^–$ ions
(2) it contains Cs^+, $I^–$ and lattice I_2 molecule
(3) it is a covalent molecule
(4) it contains Cs^+ and $I_3^–$ ions.
Solution:
$CsI_3 \rightarrow Cs^+ + I_3^–$
CsI_3 contains Cs^+ and $I_3^–$.
Hence option (4) is the answer.

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11. The synthesis of alkyl fluorides is best accomplished by
(a) Finkelstein reaction
(b) Swart's reaction
(c) free radical fluorination
(d) Sandmeyer's reaction.
Solution:
Alkyl fluorides are more conveniently prepared indirectly by heating suitable chloro or bromoalkanes with inorganic fluorides.
$CH_3Br + AgF \rightarrow CH_3F + AgBr$
This reaction is called Swart's reaction.
Hence option (b) is the answer.

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12. In the Goldschmidt alumino thermic process, which of the following reducing agents is used?

(1) Calcium

(2) Coke

(3) Sodium

(4) Al-powder

Solution:

In the Goldschmidt alumino thermic process, Aluminium is used as the reducing agent.

Hence option (4) is the answer.

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13. The copper wire test for halogens is known as:-

(1) Duma’s Test
(2) Beilstein’s Test
(3) Lasssigne’s Test
(4) Liebig’s Test

Solution:
The copper wire test for halogens is known as Beilstein’s Test.
Hence option (2) is the answer.

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14. Polymer formation from monomers starts by

(1) condensation reaction between monomers

(2) coordinate reaction between monomers

(3) conversion of monomer to monomer ions by protons •

(4) hydrolysis of monomers

Solution:

Polymerisation starts either by addition or condensation reactions between monomers.

Hence option (1) is the answer.
