Brainiacs Chemistry Olympiad Preliminary Round Sample Exam Paper 2

Category II – grades 9 and 10

Q1.
Which of the following species has the largest ionic radius?
A) Na^+
B) Mg^{2+}
C) O^{2-}
D) F^-

Q2.
Which of the following pairs are isotopes?
A) ^{12}C and ^{12}O
B) ^{12}C and ^{14}C
C) ^{16}O and ^{16}N
D) ^{1}H and $^{1}H^-$

Q3.
In the periodic table, elements in the same group have:
A) Same atomic mass
B) Same number of protons
C) Same number of valence electrons
D) Same number of neutrons

Q4.
Which of the following is true for alcohols?
A) They are hydrocarbons.
B) They contain a hydroxyl group (-OH).
C) They are saturated hydrocarbons.
D) They have the formula C_nH_{2n+2}.

Q5.
Diamond and graphite are examples of:
A) Simple molecular substances
B) Ionic compounds
C) Giant covalent structures
D) Metallic structures

Q6.
What is the IUPAC name of CH3-CH2-CH=CH2?
A) Propene
B) Butene

C) But-1-ene
D) But-2-ene

Q7.
Which reaction is endothermic?
A) Combustion of methane
B) Photosynthesis
C) Neutralization of HCl and NaOH
D) Freezing of water

Q8.
Which of the following reactions is used to distinguish between alkanes and alkenes?
A) Reaction with bromine water
B) Reaction with sodium
C) Reaction with oxygen
D) Reaction with hydrochloric acid

Q9.
How many moles of atoms are there in 0.5 mol of P_4O_{10}?
A) 4
B) 5
C) 6
D) 7

Q10.
Which of the following statements is correct for an exothermic reaction?
A) The enthalpy of products is higher than that of reactants.
B) Heat is absorbed from the surroundings.
C) The surroundings become warmer.
D) The reaction occurs only in the presence of light.

Q11.
A student heats 10 g of $CaCO_3$ until it completely decomposes.
What mass of CO_2 will be produced?
A) 4.4 g
B) 8.8 g
C) 22.0 g
D) 44.0 g

Q12.
What is the value of n, if 0.5 mol of C_nH_{2n} is 21 grams?
A) 1
B) 2
C) 3
D) 4

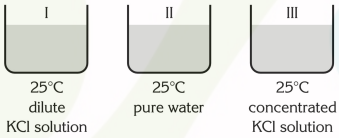
Q13.
Why does a catalyst increase the rate of a chemical reaction?
A) It increases the concentration of reactants.
B) It provides an alternative pathway with lower activation energy.
C) It makes reactants more stable.
D) It increases the energy of the reactants.

Q14.

I. The boiling points : III > I > II

II. The freezing points : II > I > III

III. The electrical conductivity : III > I > II



Which of the given comparison(s) is/are true for the substances given above?
A) I only
B) I and II
C) I and III
D) I, II and III

Q15.
How many grams of $FeSO_4x7H_2O$ must be dissolved in water to obtain 304 g of 5% iron (II) sulfate ($FeSO_4$) solution?
A) 27,8g
B) 19,6g
C) 32,5g
D) 12,24g

Q16.
Lactic acid is a compound (containing C, H and O), with a molar mass of 90g/mol. 25.2 g of lactic acid contains 10.08 g of carbon and 13.44 g of oxygen. What is the molecular formula of lactic acid?
A) $C_3H_6O_3$
B) CH_2O
C) C_2H_6O
D) C_3H_8O

Q17.
The mixture of oxygen and helium is 9.8 gram, and has a volume of 31.36 liters, at STP. What is the number of moles of helium gas in the given mixture?
A) 1 mol
B) 1,25 mol
C) 1,5 mol
D) 2 mol

Q18.

Let us assume that 5.4 g of Al metal is dipped into 400 mL HCl solution. If after 1000 seconds, all the Al metal is consumed, what would be the average rate of reaction in terms of rate of appearance of $AlCl_3$, in M/s?

A) 1×10^{-3}

B) 2×10^{-3}

C) 5×10^{-3}

D) 1×10^{4}

Q19.

How many liters of NaOH with a pH of 11 are required to neutralize a 200 mL of HCl solution with a pH of 2?

A) 1L

B) 2L

C) 3L

D) 4L

Q20.

A sample of anhydrous ethanol weighing 46.23 g, containing 0.5% phosphorus(V) oxide (P_4O_{10}) as an impurity, was burned in a thick metal vessel in the presence of sufficient oxygen. The resulting solution was heated until all gases were completely removed. Subsequently, an equal mass of 0.5% potassium hydroxide (KOH) solution was added to the solution. Determine the substances present in the resulting solution and their quantities.

A) 0,04 mol NaH_2PO_4

B) 0,05 mol NaH_2PO_4

C) 0,06 mol NaH_2PO_4

D) 0,07 mol NaH_2PO_4