National Chemistry Bowl RR4

1) General Chemistry, Short Answer – The tendency of heavy elements, such as thallium and lead, to prefer lower oxidation states is explained by what effect, in which s-electrons of the outermost shell of heavy p-block elements are less likely to participate in bonding?

Answer: Inert Pair Effect [Abhinav Senthil]

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2) General Chemistry, Short Answer – The Cannizzaro reaction is the reaction of two moles of an aldehyde to form one mole of a carboxylic acid and one mole of an alcohol. What is the name for this type of reaction, where one species is both oxidized and reduced?

Answer: Disproportionation

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3) General Chemistry, Short Answer – What effect refers to the scattering of light by particles in a colloid or fine suspension, making the light path visible?

Answer: Tyndall Effect [Abhinav Senthil]

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4) General Chemistry, Short Answer – What rule states that every orbital in a subshell will be occupied by one electron before starting to pair electrons?

Answer: Hund's Rule

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5) Organic Chemistry, Multiple Choice – An Acid Chloride is reacted with lithium dimethylcuprate. Which of the following describes the final product?

W)Primary Alcohol
X)Secondary Alcohol
Y)Ketone
Z) Carboxylic Acid

Answer: Y) Ketone [Abhinav Senthil]

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6) General Chemistry, Short Answer – What principle states the transition state of an endothermic reaction will resemble the products?

Answer: Hammond Postulate [Abhinav Senthil]

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7) General Chemistry, Multiple Choice – Alyssa wants to prepare a buffer solution. Which of the following sets of reagents could she not use to prepare a buffer?

W) Pyridine and Hydrochloric Acid
X) Pyridine and Hydrofluoric Acid
Y) Sodium Hydroxide and Hydrofluoric Acid
Z) Sodium Hydroxide and Perchloric Acid

Answer: Z) Sodium Hydroxide and Perchloric Acid

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8) General Chemistry, Short Answer – Rank the following three elements by increasing ionization energy:

1) Carbon
2) Nitrogen
3) Oxygen

Answer: 1,3,2 [Abhinav Senthil]

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9) General Chemistry, Multiple Choice – Which of the following elements will have electronegativity closest to that of Beryllium:

W) Lithium
X) Sodium
Y) Aluminum
Z) Magnesium

Answer: Y) Aluminum [Abhinav Senthil]

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10) Organic Chemistry, Short Answer – When benzene is reacted with Sodium Metal and methanol, with Ammonia acting as a solvent, it forms 1,4-cyclohexadiene. What is the name for this reaction?

Answer: Birch Reduction [Abhinav Senthil]

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11) General Chemistry, Short Answer – Superconductivity conventionally arises from the ability of electrons to form pairs, making use of lattice vibrations. What is the name of these pairs?

Answer: Cooper Pairs [Abhinav Senthil]

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12) General Chemistry, Short Answer – Rank the following three elements by increasing ionization energy:

1) Krypton
2) Fluorine
3) Neon

Answer: 1,2,3

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13) General Chemistry, Short Answer – The decline in atomic radius in the lanthanide series due to the poor shielding effect of the 4f orbitals is known as what?

Answer: Lanthanide Contraction [Abhinav Senthil]

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14) General Chemistry, Short Answer – Many liquids, including water, can be lowered below their freezing points in a phenomenon known as supercooling. Supercooled water is stable provided it is subjected to no more than small disturbances due to the fact that it experiences what type of equilibrium state?

Answer: Metastable [Abhinav Senthil]

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15) Organic Chemistry, Short Answer – What term is used to refer to any reaction in which two molecules undergo addition accompanied by the loss of a small molecule such as water, carbon dioxide, or nitrogen gas?

Answer: Condensation [Abhinav Senthil]

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16) General Chemistry, Short Answer – Rank the following three elements by increasing reduction potential:
1) Platinum
2) Palladium
3) Nickel

Answer: 3,2,1 [Abhinav Senthil]

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17) General Chemistry, Short Answer – What principle dictates the order in which atomic orbitals are filled by electrons?

Answer: Aufbau Principle [Abhinav Senthil]

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18) General Chemistry, Short Answer – By name or number, identify all of the 3 following ions that are colorless in an aqueous solution:
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1) Sc^{3+}
2) Zn^{2+}

3) Co^{2+}

Answer: 1,2 [Abhinav Senthil]

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19) General Chemistry, Short Answer – What are the molecular and electron geometries, respectively, of xenon difluoride?

Answer: linear and trigonal bipyramidal [Abhinav Senthil]
(DO NOT ACCEPT: trigonal bipyramidal and linear)

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20) Organic Chemistry, Short Answer – A straight chain alkene has molecular formula $C_{15}H_{18}$. How many double bonds must it have?

Answer: 7 [Abhinav Senthil]