Chemistry

1. Choose the correct equation for formation of lead chloride from lead nitrate:

A) $Pb^{2+} + 2\ Cl^- \rightarrow PbCl_2$

b) $PbNO_3 + Cl^- + Na^+ \rightarrow Pb^+ + NO_3^- + NaCl$

c) $PbNO_3 + Cl^- + Na^+ \rightarrow Pb^+ + NO_3^- + Na^+ + Cl^-$

d) $Pb^+ + NO_3^- + NaCl \rightarrow Pb^+ + NO_3^- + Na^+ + Cl^-$

2. What is the product of hydrogenation of pyridine?

a) Aminobenzene

b) Nitrobenzene

c) Pyrimidine

D) Piperidine

3. Consider the reaction

$HOOC–COOH \rightarrow HCOOH + CO_2$

An enzyme catalysing this reaction belongs to

A) lyases

b) transferases

c) ligases

d) oxidoreductases

4. How many grams of HCl must react with ferrous sulfide to obtain 44.8 liters of sulfane?

$A_r(Cl) = 35.5$; the reaction proceeds at standard temperature and pressure.

a) 63 g

b) 73 g

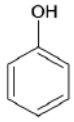
c) 126 g

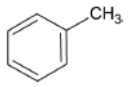
D) 146 g

5. Which of these compounds most easily cleaves a proton?

a) $CH_3–OH$

b) $H_3C–CH_2–OH$

C) 

d) 

Biology

1. **Water eutrophication leads in its final phase to**
   A) oxygen depletion.
   b) improvement of water quality.
   c) increase of nutrient content.
   d) increase of oxygen content.

2. **Blood pressure in a standing human reaches its minimum in**
   A) the right atrium.
   b) skeletal muscle capillaries.
   c) veins of lower extremities.
   d) caval veins.

3. **Collateral circulation is able to provide sufficient blood supply in the:**
   a) brain.
   b) heart muscle.
   C) skeletal muscles.
   d) retina.

4. **What is causing structural chromosome aberrations?**
   A) DNA double stranded breaks.
   b) Multiplication of the whole chromosome set.
   c) Loss of one or more chromosomes.
   d) Gain of an extra chromosome.

5. **What could be said about human hemophilia A?**
   a) It leads to a hypercoagulation state.
   b) The molecular cause is an atypical hemoglobin structure.
   c) It is inherited in gonosomal (X-linked) dominant fashion.
   D) It can cause severe internal bleeding (e.g. into joints or muscles).

Physics

1. **To heat an ice cube weighing 10 kg by 10 °C we need to supply 210 kJ of heat.**
   How much heat do we need to supply to heat 10 kg of water by 5 °C, if the specific heat capacity of water is $4.2\ kJ \cdot kg^{-1} \cdot K^{-1}$?

   A) The same amount as to heat the ice cube.

   b) Twice as much as to heat the ice cube.

   c) Half less than to heat the ice cube.

   d) Four times as much as to heat the ice cube.

2. **The heat supplied to an ideal gas is zero during the**

   a) isothermal process.

   b) isochoric process.

   c) isobaric process.

   D) adiabatic process.

3. **Work W performed by applying pressure $p = 40$ kPa of the liquid on a piston with an area of 2000 cm^2, which has shifted by 50 cm, is**

   a) $W = 400$ J

   b) $W = 800$ J

   C) $W = 4$ kJ

   d) $W = 40$ kJ

4. **Assuming that v is phase velocity, T period, λ wavelength, and f frequency of mechanical waves, which of the following relationships is correct?**

   A) $\lambda = v \cdot T$

   b) $\lambda = v / T$

   c) $\lambda = v \cdot f$

   d) $v = \lambda / f$

5. **To control the power of a nuclear reactor, the control rods are inserted among the fuels cells. In order for regulation to be effective, the control rods should be from**

   a) carbon

   B) cadmium

   c) lead

   d) copper