Dr. Sasha

It is the information about the task N24

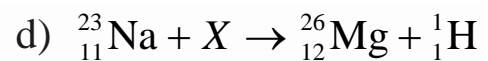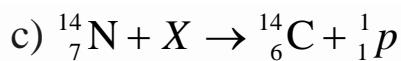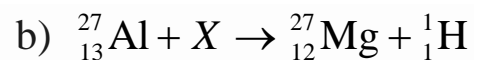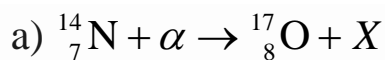**1)-2)** I agree with the solution.

3) How would you use the phosphorus (P^{32} or P^{31}) in agriculture?

4)-6) I agree with the solution.

Please, solve this problem and also show the steps to solve it.

28.06.2015 – N25

**1)** Identify the unknown particles in these nuclear transmutations.

a) $^{14}_{7}N + \alpha \rightarrow {}^{17}_{8}O + X$

b) $^{27}_{13}Al + X \rightarrow {}^{27}_{12}Mg + {}^{1}_{1}H$

c) $^{14}_{7}N + X \rightarrow {}^{14}_{6}C + {}^{1}_{1}p$

d) $^{23}_{11}Na + X \rightarrow {}^{26}_{12}Mg + {}^{1}_{1}H$

2) Gold has only one naturally occurring isotope, ^{197}Au. If a piece of gold foil is irradiated with neutrons, neutron capture will occur and a radioactive isotope of gold will be produced. This radioisotope is a beta emitter. Write an equation that describes this nuclear reaction.

3) Modern ionization smoke detectors contain about 0.28 microgram of ^{241}Am, which is a radionuclide. ^{241}Am, in the form of americium dioxide, is used as the source of ionizing radiation (see figure below).

Alpha source
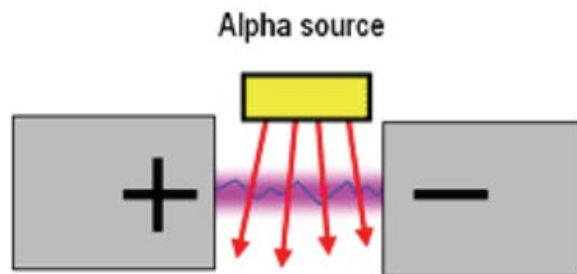
Current due to ionisation flows from + to -
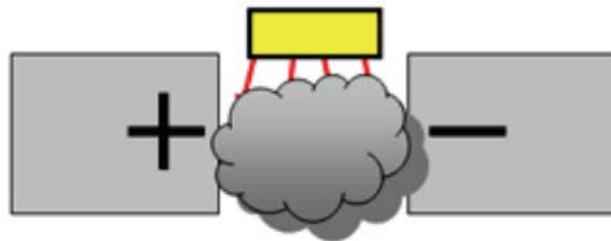
Current flow stopped by smoke

A smoke detector contains a pair of oppositely charged low-voltage metal electrodes. When the alpha particles pass between these electrodes, they ionize the air molecules that are present. These ions are then attracted to the electrodes. However, when smoke is present, the ions attach themselves to the smoke particles. The flow of charges to the electrodes reduces greatly. ^{241}Am has a half-life of 432.2 years, and decays into ^{237}Np. Write an equation that describes this nuclear reaction and calculate the lifetime of the smoke detector.

4) The ratio of ^{14}C to ^{12}C atoms in a sample of the linen wrappings on an Egyptian mummy was found to be $0.60 \cdot 10^{12}$. Given that the half-life of ^{14}C is 5570 years, and that the ratio in modern linen of the same type is $1.00 \cdot 10^{12}$, calculate the age of the mummy.

5) A piece of wood is taken from an archaeological artefact. 10 mg of carbon is extracted from the wood and this yields 66 counts over a period of 12 hours from the ^{14}C present in the sample. If the equilibrium decay rate of ^{14}C is 14 disintegrations per min per gram of freshly-prepared carbon, calculate the age of the wood (half-life of ^{14}C is 5570 years).

6) A wooden sample from an ancient, excavated shield is found to have an activity of 0.090 Bq. A sample of living wood of the same mass has an activity of 0.105 Bq.

Given that the half-life of ^{14}C is 5570 years, calculate the age of the shield sample.