Combined science - Physics
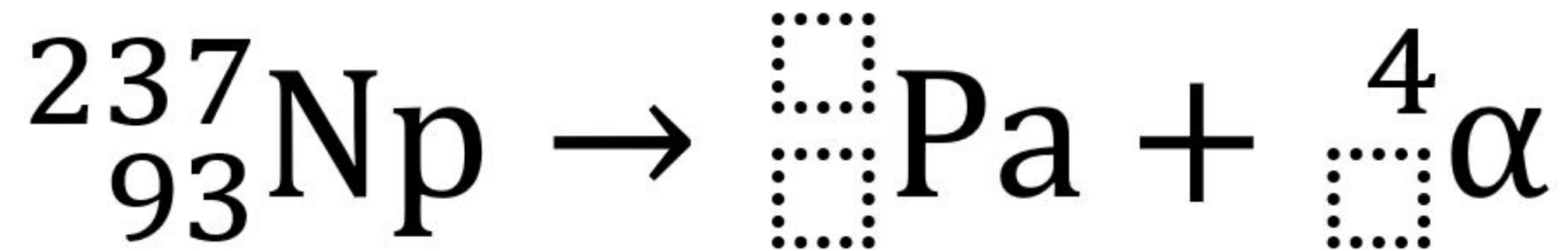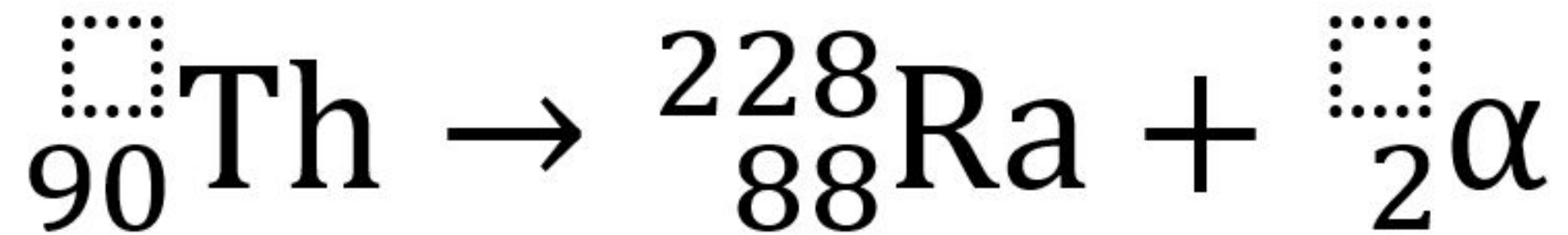
Key stage 4 - Atomic Structure

Decay Equations
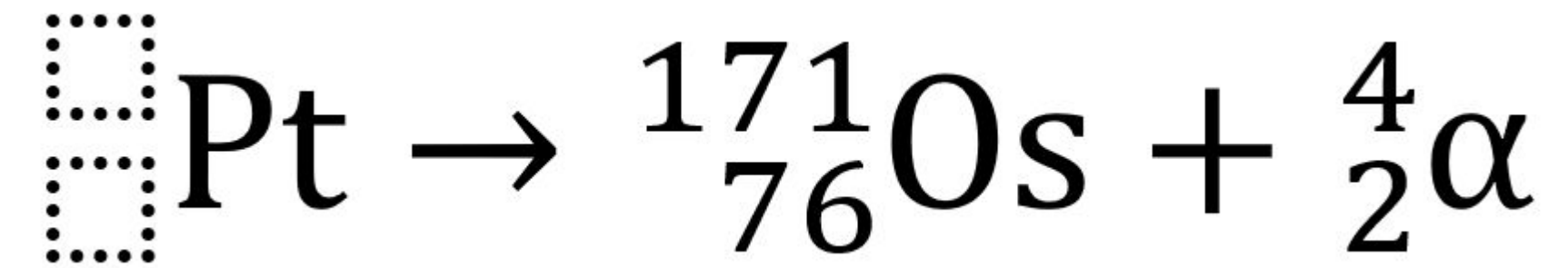
Mr van Hoek

I do, we do, you do

$$^{90}_{38}\text{Sr} \rightarrow \, ^{\square}_{\square}\text{Kr} + \, ^{4}_{2}\alpha$$

$$^{\square}_{90}\text{Th} \rightarrow \, ^{228}_{88}\text{Ra} + \, ^{\square}_{2}\alpha$$

$$^{237}_{93}\text{Np} \rightarrow \, ^{\square}_{\square}\text{Pa} + \, ^{4}_{\square}\alpha$$

I do, we do, you do

$$^{\square}_{\square}\text{Pt} \rightarrow {}^{171}_{76}\text{Os} + {}^{4}_{2}\alpha$$

$$^{149}_{64}\text{Gd} \rightarrow {}^{\square}_{\square}\text{Sm} + {}^{\square}_{\square}\alpha$$
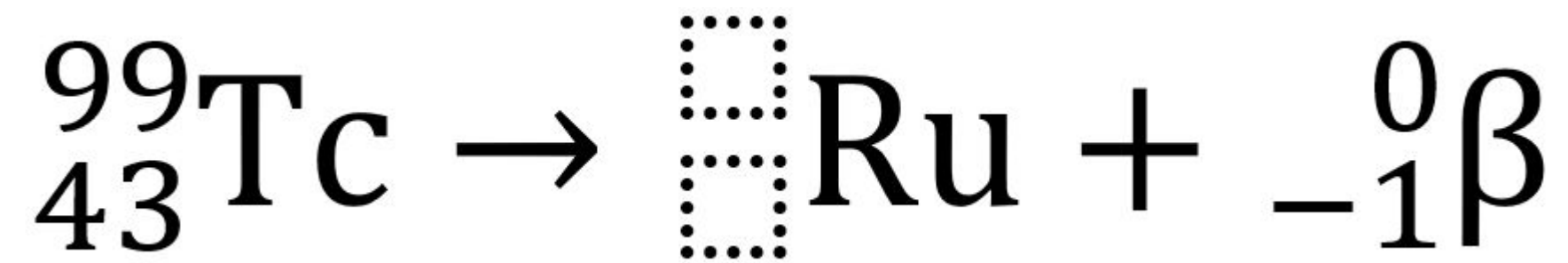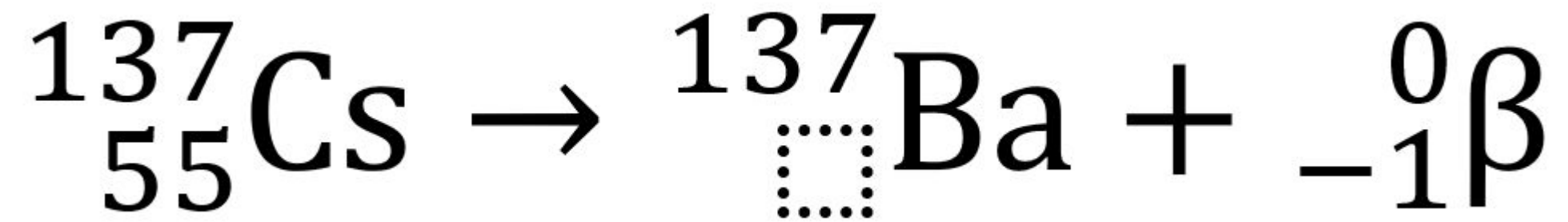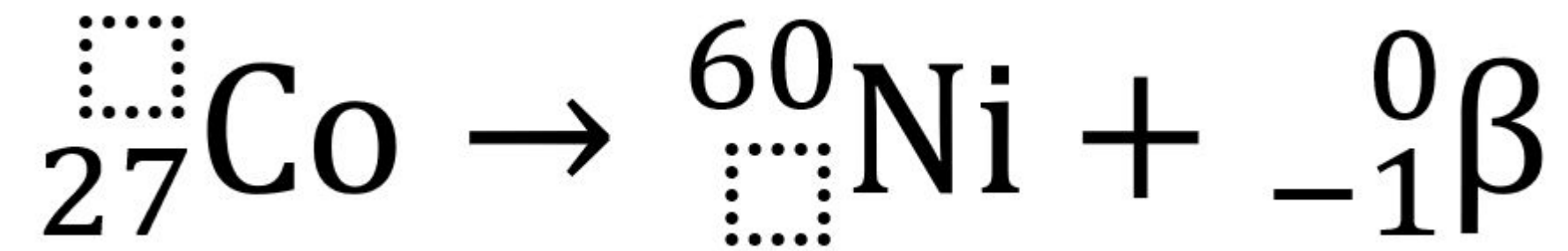
Alpha decay questions

1. What is the atomic mass number of the emitted Alpha particle?
2. Write the general form of alpha decay.
3. What is the number of protons in an alpha particle?
4. What is the number of neutrons in an alpha particle?
5. How do you write an alpha particle?
6. When Uranium-238 decays by alpha decay, how much will the mass number decrease by?
7. Neptunium-237 can decay to Protactinium via alpha decay. What will be the mass number of the Protactinium isotope?

I do, we do, you do

$$^{137}_{55}Cs \rightarrow {}^{137}_{\square}Ba + {}^{0}_{-1}\beta$$

$$^{99}_{43}Tc \rightarrow {}^{\square}_{\square}Ru + {}^{0}_{-1}\beta$$

$$^{3}_{1}H \rightarrow {}^{\square}_{\square}He + {}^{0}_{-1}\beta$$

I do, we do, you do

$$\square\square K \rightarrow {}^{40}_{20}Ca + {}^{0}_{-1}\beta$$

$$\square\square_{27}Co \rightarrow {}^{60}_{\square\square}Ni + {}^{0}_{-1}\beta$$

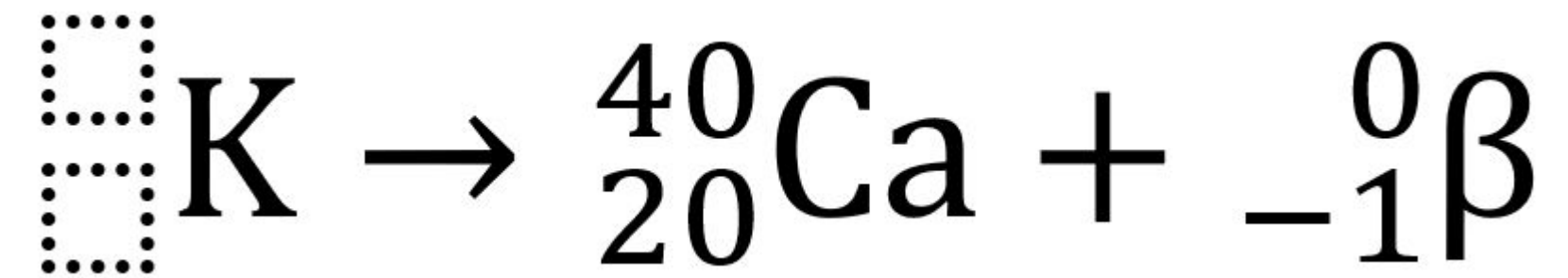$$^{20}_{\square\square}F \rightarrow {}^{\square\square}_{10}Ne + {}^{0}_{-1}\beta$$

Beta decay questions

1. What is the atomic mass number of the emitted beta particle?
2. Write the general form of beta decay.
3. What is a beta particle?
4. How do you write an beta particle?
5. When Sodium-22 decays by beta decay, how much will the proton number change by?
6. Technetium-99 can decay to Ruthenium via beta decay. What will be the mass number of the Ruthenium isotope?

Which decay, and how can you tell?

$^{201}_{79}\text{Au}$ decays to $^{201}_{80}\text{Hg}$

$^{231}_{91}\text{Pa}$ decays to $^{227}_{89}\text{Ac}$

$^{185}_{79}\text{Au}$ decays to $^{181}_{77}\text{Ir}$

$^{52}_{26}\text{Fe}$ decays to $^{52}_{27}\text{Co}$

Question 1

An atom of uranium-238 $^{238}_{92}U$ decays to form an atom of thorium-234 $^{234}_{90}Th$

a) What type of radiation, alpha, beta or gamma, is emitted by uranium-238?

b) Why does an atom that decays by emitting alpha or beta radiation become an atom of a different element?
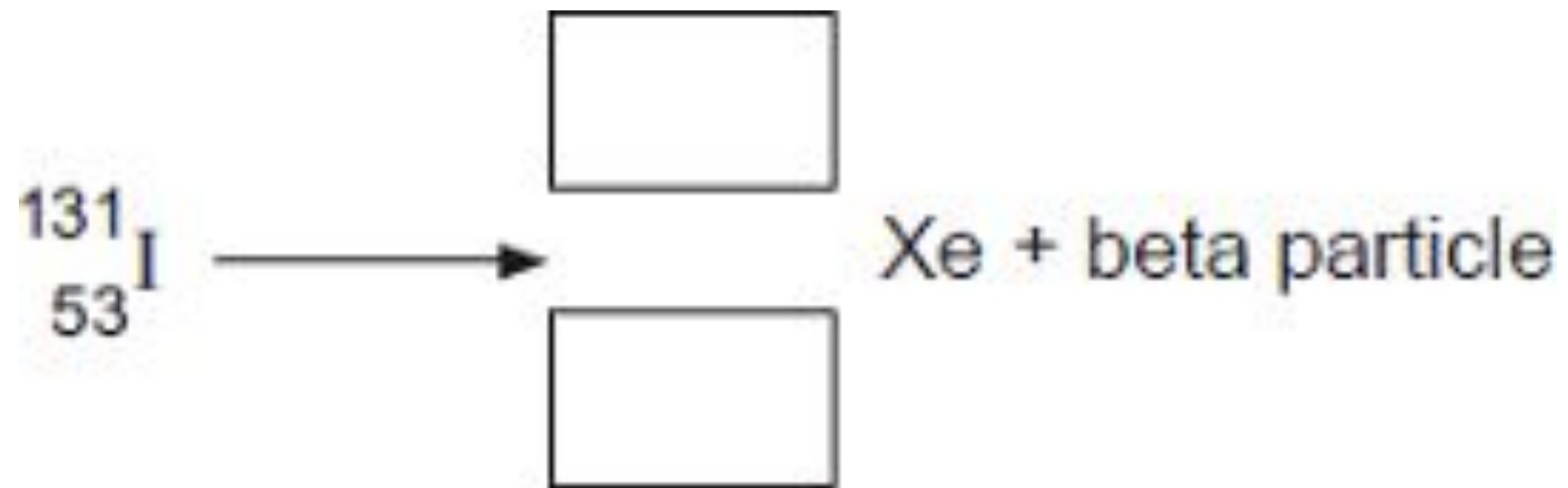
Question adapted from ExamPro

Question 2

$^{99}_{43}\text{Tc}$ (technetium) is produced by the radioactive decay of $^{99}_{42}\text{Mo}$ (molybdenum). What change occurs in the nucleus of a molybdenum atom when this happens?

Question from ExamPro

Question 3

An atom of iodine-131 decays into an atom of xenon (Xe) by emitting a beta particle.

The decay of iodine-131 can be represented by the equation below.

Complete the equation by writing the correct number in each of the **two** boxes.

$$^{131}_{53}\text{I} \longrightarrow \boxed{}\ \text{Xe} + \text{beta particle}$$

Question from ExamPro

Question 4

An atom of the isotope radon-222 emits an alpha particle and decays into an atom of polonium.

An alpha particle is the same as a helium nucleus.
The symbol to the right represents an alpha particle.

$$^{4}_{2}He$$

a) How many protons and how many neutrons are there in an alpha particle?

      Number of protons = _____

      Number of neutrons = _____

b) The decay of radon-222 can be represented by the equation below.

  Complete the equation by writing the correct number in each of the **two** boxes.

$$^{222}_{86}Rn \longrightarrow \ ^{\boxed{}}_{\boxed{}}Po \ + \ \text{alpha particle}$$

Question adapted from ExamPro

Answers

1. a) alpha   b) number of protons changes, *accept atomic number changes accept _loses or gains_ protons*

2. neutron becomes proton / neutron emits electron / neutron emits beta particle

3. 131 (top) and 54 (bottom)

4. a) 2 protons, 2 neutrons   b) 218 (top), 84 (bottom)