Radioactive Decay Practice Problems

PART A: Identify each of the following as describing alpha (α), beta (β), or gamma decay/emission (γ).

1. \( _{-1}^{0}e \) ________________  
2. \( _{4}^{4}He \) ________________  
3. \( _{0}^{0}γ \) ________________

4. Nuclear decay with no mass and no charge ________________

5. Decay emitting an electron________________

6. Nuclear decay giving off a helium nucleus________________

7. Least penetrating nuclear decay________________

8. Most damaging nuclear decay to the human body________________

9. Nuclear decay that can be stopped by skin or paper ________________

10. Nuclear decay that can be stopped by aluminum ________________

PART B: Write the symbols for an alpha particle, a beta particle, and gamma ray.

PART C: Balance these nuclear equations by filling in the blank for the missing reactants or products. Then, identify the type of reaction that is shown in each equation.

A. \( ^{42}_{19}K \rightarrow _{-1}^{0}e + \ldots \)

B. \( ^{239}_{94}Pu \rightarrow _{4}^{4}He + \ldots \)

C. \( ^{238}_{92}Np \rightarrow \ldots + _{4}^{4}He \)

D. \( ^{208}_{85}At \rightarrow \alpha + \ldots \)

E. \( \ldots \rightarrow ^{252}_{95}Es + β \)

F. \( ^{104}_{38}Ag \rightarrow _{-1}^{0}e + \ldots \)
PART D: Write the equation for the nuclear reaction described in each of the following processes.

1. Americium-241 ($^{241}$Am) undergoes alpha decay (inside a smoke detector)

\[
^{235}\text{U} \rightarrow \quad + ^{231}\text{Th}
\]

2. Iodine-131 ($^{131}$I) undergoes normal beta decay (used in therapy for hyperthyroidism)

\[
\quad \rightarrow ^{222}\text{Rn} \quad + ^{4}\text{He}
\]

3. Technetium-99m ($^{99m}$Tc) undergoes gamma decay to form $^{99}$Tc (a diagnostic radioactive tracer used to locate tumors, the “m” indicates a metastable excited nuclear state)

\[
^{238}_{92}\text{U} \rightarrow ^{4}_{2}\text{He} \quad + \quad + \gamma
\]

4. The alpha decay of iridium-174

\[
^{229}\text{Th} \rightarrow ^{4}_{2}\text{He} \quad + \quad
\]

5. The beta decay of platinum-199

6. The alpha decay of radon-198

7. The beta decay of uranium -237