1) $r = 1.2 \times 10^{15} \sqrt[3]{238}$
$= 7.43 \times 10^{15}$

2) $V_\alpha = 0.05c$
$V_\beta = 0.9 c$

$\dfrac{v_\beta}{v_\alpha} = \dfrac{0.9}{0.05} = 18$

$\boxed{V_\beta = 18 \, V_\alpha}$

1. Find the radius of a ^{238}P nucleus.

2. What is the ratio of the velocity of a β particle to that of an α particle, if they have the same nonrelativistic kinetic energy? 3.10756×10^{-17}

3. The decay constant of ^{235}U is $\boxed{9.8 ⬚ 10^{-10}}$ y $^{-1}$. (a) Calculate the half-life. (b) How many decays per second occur initially in a 1.0-μg sample of ^{235}U? (c) How many ^{235}U nuclei will remain in the 1.0 μg -μg sample after 10^9 y?

$t=0$ $\quad 1\mu g$

$T_{\frac{1}{2}} = \dfrac{0.693}{\lambda} = 2.23 \times 10^{6}$

3) decay $= R$ $m = 1 \times 10^6 g$
second
$235 \to 6.02 \times 10^{23}$
$1 \times 10^6 \to x$ $N = 2.56 \times 10^{15}$

c) $N = N_0 e^{-\lambda t}$ $t = 10^9$
$= 3.153 \times 10^{16}$
$= 2.562 \times 10^{16} e^{-1}$ $\lambda = (1.2 \times 10^{16})$
$= 9.61 \times 10^{14}$ Nu

4. ^{62}Cu is produced at a constant rate in a reactor and decays by $\boxed{\beta^-}$ decay with a half-life of about 10 min. How long does it take to produce $\boxed{90 \%}$ of the maximum possible number of ^{62}Cu?

$\lambda = \dfrac{0.693}{100} = 1.155 \times 10^{-3}$

Maximum possible number $= N_0$
90%: $\to 0.9 N_0 = N$
$0.9 N_0 = N_0 e^{-\lambda t}$
$0.9 = e^{-\lambda t}$
$t = \dfrac{\ln 0.9}{-1.155 \times 10^{-3}} = 91.22 (s)$
$= 1.5 (min)$

5. The half-life of ^{227}Th is 18.72 d. It decays by $\boxed{\alpha}$ emission to ^{223}Ra, an $\boxed{\alpha}$ emitter whose half-life is 11.43 d. A particular sample contains 10^6 nuclei of ^{227}Th and no ^{223}Ra at $t = 0$. How many nuclei of ^{223}Ra will be in the sample at $t = 15$ d?

6. A sample of animal bone discovered at an archeological site is found to contain $\boxed{175 \text{ g}}$ of carbon, and the decay rate of ^{14}C in the sample is measured to be 8.1 Bq. How old is the bone?

7. 350 rads of α particle radiation is equivalent to how many rads of X-rays in terms of biological damage?

فانا

$1\alpha \to 20$ x-rays
$350 K \to$ مجهول
اذا ضربنا في 7000 نجد

8. A dose of $\boxed{4.0 \text{ Sv}}$ of rays in a short period would be lethal to about half the people subjected to it. How many grays is this?

Effective dose (Sv) = Dose (Grey) × RBE
$4S = $ Dose (Grey) × 1
Dose 4 Grey   أكبر

9. How many rads of slow neutrons will do as much biological damage as 72 rads of fast neutrons?

10. How much energy is deposited in the body of a 65-kg adult exposed to a 4.5-Gy dose?

TABLE 31–1 Relative Biological Effectiveness (RBE)

Type	RBE
X- and γ rays	1
β (electrons)	1
Protons	2
Slow neutrons	5
Fast neutrons	≈ 10
α particles and heavy ions	≈ 20

$14 \to 6.02 \times 10^{23}$

6) $175 \to N_0$

$N_0 = 75.25 \times 10^{23}$

$R = \lambda N$
$N = \dfrac{R}{\lambda} = \dfrac{8.1}{3.83 \times 10^{-12}} = 2.112 \times 10^{12}$

$T_{\frac{1}{2}} = 5730 \, y$

$\lambda = \dfrac{0.693}{5730 \times 365 \times 24 \times 360} = 3.835 \times 10^{-12}$

$N = N_0 e^{-\lambda t}$

$t = 7.536 \times 10^{12} \, s$

$= 238,960 \, yr$

9)   1 fast $\longrightarrow$ 10 x-rays

72 fast $\longrightarrow$ x

$$x = 720$$

1:1

1 slow $\longrightarrow$ 5 x-rays

num slow $\longrightarrow$ 720

$$x = \frac{720}{5} = 144 \text{ rads}$$

10)   1 gray $= 1 J / kg$

4.5 gray $=$ Energs

Energy $= 4.5 J / kg$

Energy $= 4.5 (65) = 292.5 J$