

Dr. Sasha

It is the information about the task N24

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

It is the information about the task N25

4) the correct version of the task is: The ratio of ^{12}C to ^{14}C atoms in a sample

5) Explanation: “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”. **This sentence means that, the Geiger counter detected 66 times decay of the ^{14}C over a period of 12 hours.**

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

30.06.2015 – N26

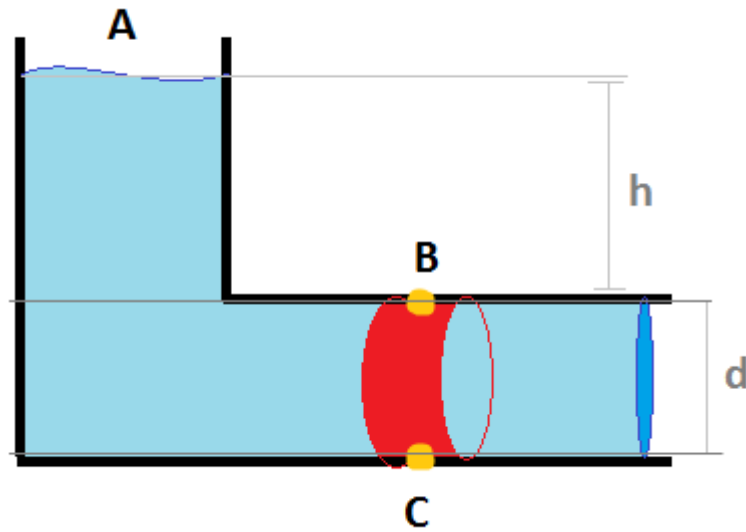
1) ^{234}Th decays by beta emission. The following data were collected on a sample of ^{234}Th .

Mass (g)	Time (days)
36.0	0
31.2	5
23.4	15
15.2	30
11.4	40
7.4	55

Calculate the half-life for the isotope and what is the measurement error for this half-life?.

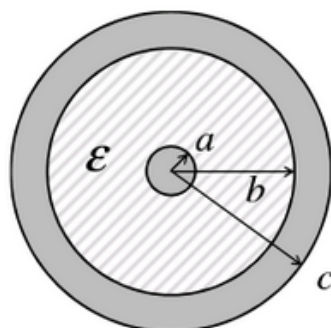
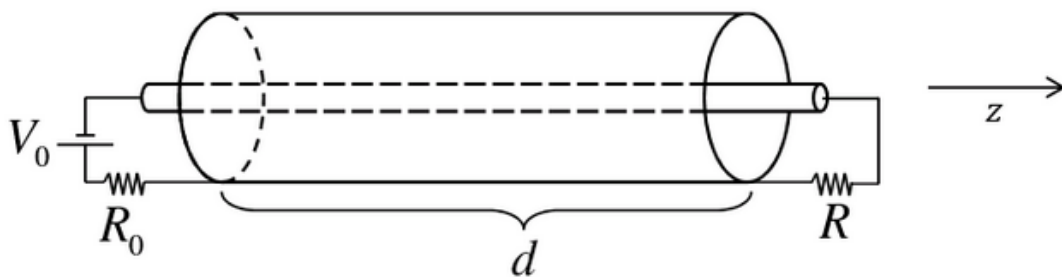
2) ^{238}U has a decay constant of $T_{1/2} = 4.88 \cdot 10^{-18} \text{s}^{-1}$. If one atom of this nuclide has a mass of $3.95 \cdot 10^{-25} \text{kg}$, calculate the mass of ^{238}U which would give an activity of $2.0 \cdot 10^4 \text{Bq}$.

3) A cistern connected to a tube containing a fluid as shown in the picture below.



Assuming that the fluid is incompressible. Bernoulli's equation applied to the point B says that: $P_{atm} + \rho gh = P_{atm} + \frac{\rho v_B^2}{2}$. This implies that $v_B = \sqrt{2gh}$. But in the point C it will be $v_C = \sqrt{2g(h+d)}$. That means that every single point has a different speed despite being in the same cross-sectional area. We know from the law of continuity that every single point in the same area has to move with the same speed. What's the right equation? $v_B = v_C$ or $v_B \neq v_C$.

4) A coaxial cable consists of a wire with radius a (the core of the cable), which is wrapped with insulating material with dielectric constant ϵ , until radius b (called the insulator).



Around the cable there is a layer of conducting material (radius c from the center of the cable and is called the wrapper). The wire's length is d such that $d \gg a, b, c$. At one side of the cable, a voltage source V_0 with inner resistance R_0 is connected to both the wire and the wrapper, and at the other side, a resistor R is connected instead of a voltage source. Find the magnetic and electric fields $\vec{B}(r, t)$, $\vec{E}(r, t)$ (where $b \leq r \leq a$ is the distance from the center of the cable from z axis in the picture) generated after turn on of the voltage source.

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).