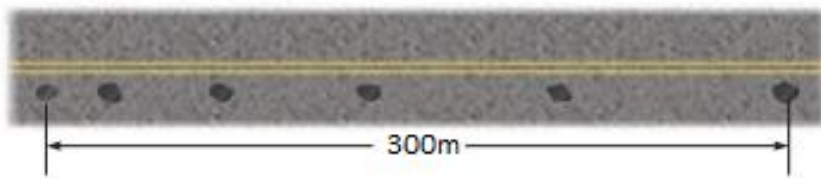


1. There are two specimen of the same radioactive nuclide. Specimen A has twice the initial activity of sample B. Compare the half-life of A with the half-life of B
 - A) it is one-fourth as large
 - B) it is four times larger
 - C) it is two times larger
 - D) it is the same
 - E) it is half as large
2. The momentum of a rigid body is increased by a factor of 2 in magnitude. Its kinetic energy changed by factor of
 - A) 8
 - B) 2
 - C) 16
 - D) 1
 - E) 4
3. A sample of an ideal gas is at room temperature. To increase the entropy of the sample needed to
 - A) increase either its temperature or its volume, without letting the other variable decrease
 - B) transfer energy into it irreversibly by heat
 - C) do work on it
 - D) transfer energy into it by heat
 - E) all actions increase the entropy of the sample
4. A fisherman spearfishing from bank sees a motionless fish a few meters away. To stab the fish, the fisherman should
 - A) aim precisely at the fish
 - B) aim above the fish
 - C) aim below the fish
 - D) aim behind the fish
 - E) aim in front of the fish
5. A cubical Gaussian surface is bisected by a negatively charged large sheet, parallel to its top and bottom faces. Find over how many of the cube's faces the electric flux is zero
 - A) 0
 - B) 6
 - C) 2
 - D) 4
 - E) 8
6. Find the assumption which is not made in the kinetic theory of gases
 - A) the number of molecules is very large
 - B) the gas is a pure substance
 - C) the average separation between molecules is large compared to their dimensions
 - D) the molecules obey Newton's laws of motion
 - E) the forces between molecules are long range

7. In the alpha decay ${}^{238}_{92}\text{U} \rightarrow {}^A_Z\text{Th} + {}^4_2\text{He}$, identify the mass number and the atomic number of the Th nucleus:
- $A = 234, Z = 90$
 - $A = 238, Z = 86$
 - $A = 238, Z = 92$
 - $A = 234, Z = 88$
 - $A = 230, Z = 88$
8. A gas undergoes an adiabatic expansion. Find the true statement
- no work is done by the gas
 - the internal energy of the gas does not change
 - the pressure increases
 - the temperature of the gas does not change
 - no energy is transferred to the gas by heat
9. Find the statement of the first law of thermodynamics
- the entropy of the Universe increases in all natural processes
 - no heat engine operating in a cycle can absorb energy from a reservoir and use it entirely to do work
 - no real engine operating between two energy reservoirs can be more efficient than a Carnot engine operating between the same two reservoirs
 - energy will not spontaneously transfer by heat from a cold object to a hot object
 - when a system undergoes a change in state, the change in the internal energy of the system is the sum of the energy transferred to the system by heat and the work done on the system
10. A drop of liquid falls straight down onto the road from the trailer of a moving truck every 4 s. Figure shows the pattern of the drops left behind on the road. Find the average speed of the truck over this section of its motion



- 10 m/s
- 8 m/s
- 20 m/s
- 25 m/s
- 15 m/s