

- 11.** Amplitude of a mass spring system, which is executing simple harmonic motion decreases with time. If mass = 500g, Decay constant = 20 g/s then how much time is required for the amplitude of the system to drop to half of its initial value?  
( $\ln 2 = 0.693$ )
- (1) 15.01 s                      (2) 17.32 s                      (3) 0.034 s                      (4) 34.65 s

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SOLUTION: GIVEN THAT THE AMPLITUDE OF THE SHM DECREASES,

so, we have the decay equation of amplitude as (from damped oscillation)

$$A = A_0 e^{-\frac{bt}{2m}}$$

here  $\gamma = \frac{-bt}{2m}$  (in Lectures, we had  $e^{-\gamma t}$ )

and  $b \equiv$  decay constant  
so, we need time for  $\frac{A_0}{2}$ ,

$$\frac{A_0}{2} = A_0 e^{-\frac{bt}{2m}} \Rightarrow \ln\left(\frac{1}{2}\right) = \frac{-bt}{2m}$$

$$\Rightarrow \frac{bt}{2m} = \ln(2)$$

$$\Rightarrow t = \frac{\ln(2) \times 2m}{b} = \frac{0.693 \times 2 \times 500}{20}$$

$$t = 34.65 \text{ sec}$$