

AP Physics C
Drozdoﬀ 8–9
Quiz — Chapter 7, 10/3/2007

There are twenty-two points available on this quiz. It will be valued at twenty points.

1 The equation for work can be expressed in any of several forms. Given a description of the situation, write the relevant equation for work. (3)

(a) Treating force F and displacement Δx as scalars with an angle θ between them.

(b) Treating force \mathbf{F} and displacement $\Delta \mathbf{x}$ as vectors and assuming \mathbf{F} is constant.

(c) Treating force \mathbf{F} and displacement $\Delta \mathbf{x}$ as vectors such that \mathbf{F} may vary with position.

2 A spring is constructed such that $\|\mathbf{F}_{\text{restoring}}\| = -kx^3$. Derive an equation for the work done to compress or stretch the spring by a distance x . *Hint: use the definition in 1c in conjunction with the power rule for antiderivatives, which states that $\int ax^n dx = \frac{a}{n+1}x^{n+1}$.* (3)

3 State the work-kinetic energy theorem and give an example of a problem to which it might be practically applied. (3)

4 The chapter poses the question “Why are fish ladders like [the one pictured] often built around dams? Do the ladders reduce the amount of work that the fish must do to get past the dam?” (182). Well, why? Do they? *If you feel that seeing a picture of a fish ladder would be helpful, let me know, and I will either laugh at you or provide one.* (3)

5 The book gives one of the equations to find power as $\mathcal{P} = \mathbf{F} \cdot \mathbf{v}$. Show the derivation of this equation using the Product Rule. State explicitly the assumption you make about one of the terms in the Product Rule's output. (4)

6 (Variant on CQ8) Given the following situations with objects A and B , evaluate the ratio $\frac{K_A}{K_B}$ (3).

(a) $m_A = 2m_B$ and $\mathbf{v}_A = \mathbf{v}_B$

(b) $m_A = m_B$ and $\mathbf{v}_A = \frac{1}{4}\mathbf{v}_B$

(c) $m_A = \frac{1}{3}m_B$ and $2\mathbf{v}_A = \mathbf{v}_B$

7 (P20, adapted) An archer pulls her bow string back 0.400 m by exerting a force that increases uniformly from zero to 230 N over a time of 4.50 s (3).

(a) What is the equivalent spring constant of the bow?

(b) How much work is done by the archer in pulling the bow?

(c) What is the average power exerted by the archer?