

Ch 7 HW Assignment: Answers & HW Hints (Pt. 1)

**Part 1: Pre-Intro to Basic Work and
Energy Ideas**

Problems given on board in class.

Basic Practice Problems

1. A 40N force acts on a 3kg block, pulling at an angle of 27° above forward. How much work does this force do as the block is pulled 92cm forward?
2. For the block in #1, how fast is it moving at the end of the 92cm, assuming it started from rest? (Don't use kinematics.)
3. A 70kg person stands in an elevator moving upwards at a constant speed. Calculate the following, during a 5 meter portion of the elevator's motion...
 - a. Work done on the person by normal force.
 - b. Work done on the person by gravity.
 - c. Net work done on the person.
4. An 88g arrow is fired from a bow whose string exerts an average force of 110N on the arrow over a distance of 78cm. What is the speed of the arrow as it leaves the bow?

Answers

1. 32.8J

2. 4.68m/s

3a. 3430J

b. -3430J

c. 0J

4. 44.2m/s

Ch 7 HW Assignment: Answers & HW Hints (Pt. 2)

Part 2: Kinetic Energy and Work

Pg. 160-161 #2, 3, 7, 8, 10, 11a-c, 13, 15

Answers

2. $1.82 \times 10^{13} \text{J}$

3a. $2.88 \times 10^7 \text{m/s}$

b. $2.1 \times 10^{-13} \text{J}$

7. 20J

8. 6.84J

10. 4950J

11a. 170N

b. 342.3m

c. -58,183J

13a. 1.5J

b. Increase, because...

15a. 62.3°

b. 117.7°

Ch 7 #13

This one is definitely easiest if you think about it with the dot-product mentality, meaning that you really only need to think about the x-direction forces, since they're the only ones that can do work during the x-direction displacement.

Ch 7 #15

Since you don't know anything about the direction of the force, you need to think about the resultant displacement. Remember that you can still use Pythagorean theorem even in 3 dimensions. It's just $R = \sqrt{d_x^2 + d_y^2 + d_z^2}$.

Ch 7 HW Assignment: Answers & HW Hints (Pt. 3)

Part 3: Work due to Gravity

Pg. 161-162 #17, 19-21, 23, 24

Answers

17a. 11,642.4J

b. -10,584J

c. 1058.4J

d. 5.42m/s

19a. $-\frac{3}{4}Mgd$

b. Mgd

c. $\frac{1}{4}Mgd$

d. $\sqrt{\frac{1}{2}gd}$

20a. 1.31J

b. 0.93m/s

21. 4.41J

23. 25J

24a. 8840J

b. 7840J

c. 6840J

Ch 7 #20

Start part A by finding the work done by each of those 3 forces. (You should get $W_a=8.66\text{J}$, $W_g=-7.35\text{J}$, and $W_N=0\text{J}$.) Just add 'em up to get the net work.

Ch 7 #21

Hint: It's moving at a constant speed.

Ch 7 #23

The weird thing here is the way the actual question is worded. But if you think hard enough... If the rope hadn't been attached to the block, then the block just would have still had all of those Joules that the rope steals. So with the rope in place, calculate how many Joules it steals, and this should answer the question.

Ch 7 #24

You should be able to use the Work-Kinetic Energy Theorem on each part of this one.

Ch 7 HW Assignment: Answers & HW Hints (Pt. 4)

**Part 4: Work by Springs and
Variables Forces in General**

Pg. 161-162 #27-29, 34, 36, 39, 40, 41

Answers

27a. +7.2J

b. +7.2J

c. 0J

d. -25.2J

28. $\pm 4.9\text{cm}$

29a. 6.56m/s

b. $\pm 4.69\text{m}$

34. +25J

36. +800J

39a. +42J

b. +30J

c. +12J

d. 6.48m/s (in pos. dir.)

e. 5.48m/s (in pos. dir.)

f. 3.46m/s (in pos. dir.)

40a. +2.33J

b. +2.64J

41. $c=4\text{N/m}$

Ch 7 #28

The only part that should be confusing here is that you're told 'our force' does +4J of work. But the formula you're trying to use has to do with the work done by the spring, not the work done by 'our force'. Well, with a little bit of thinking, you should realize that the net work on the object is 0J, since it begins and ends at rest. This simply shows us, then, that $W_{\text{spring}} + W_{\text{Ours}} = 0\text{J}$, which means that $W_{\text{spring}} = -4\text{J}$. Once you know all of this, you should be able to use the formula for work done by a spring.

Ch 7 #29

Even though this problem doesn't tell you it's a spring that's the source of the force, you can be sure that the force at least *acts* like it's caused by a spring, because of the equation $F = -6x$. This equation also tells you the apparent spring constant, which would be 6N/m . So feel free to use the formula for work done by a spring force, because this force might as well be caused by a spring, even if it's not necessarily.

Ch 7 #36&39

Just be careful when using the graphs on these, because they're given to you as acceleration vs. position graphs. We'd really prefer they were force vs. position graphs, so just switch the acceleration measurements on each axis to forces by using $F=ma$.

Ch 7 #40

Part A should be okay if you remember the integral version of the work formula. But for part B, you do need to use some slightly different calculus thinking: The max value of any function will occur when the derivative of that function equals zero. And since you're looking for max KE, you might as well be looking for max work. But the derivative of your work function must be the force function that you started with. So anyway, just set your force function equal to zero, and solve for the position at which the max KE occurs. Then find how much work has been done at this position.

Ch 7 #41

Since you know the particle's KE at $x=3\text{m}$, that must mean you also know how much work has been done on the particle by the time it arrives at $x=3\text{m}$. So set this work equal to the integral of $F(x)dx$ (evaluated from $x=0\text{m}$ to 3m), and you should see that the only unknown left is C .

Ch 7 HW Assignment: Answers & HW Hints (Pt. 5)

Part 5: Power

Pg. 163 #43, 44, 46a, 48-50

Answers

43. 487.2W

44. 268,435 W

46a. 900J

48a. 28W

b. (6m/s) \hat{j}

49a. 101J

b. 8.42W

50a. 0W

b. -353.6W

Ch 7 #50

Part A should make sense, since the force is momentarily zero, so the instantaneous power must be momentarily zero. Part B is a little rougher... The instantaneous power can be found by $P = \mathbf{F} \cdot \mathbf{v}$ (dot product). So you need to find the instantaneous force with Hooke's law, and also find the instantaneous speed with the work-KE theorem.