Physics 11 Unit 3 Energy Worksheet #2

Name: ______________ Date: ______________

- $KE = E_K = \frac{1}{2} mv^2$
- $P = W/t$
- $PE = E_p = mgh$
- $E_i = E_f$
- $W = F d$
- Eff = useful/total

1. How much work does it take to lift a 5 kg block up 4.6 m in 5 seconds?

$W = F \cdot d = (5)(9.8)(4.6) = 225\ J$ distractor.

F_g

2. How much power does it take to lift a 78 kg box up 1.4 m in 5 seconds.

$$P = \frac{W}{t} = \frac{F_g \cdot h}{t} = \frac{(78)(9.8)(1.4)}{5} = 214\ W$$

3. How much useful power does a 200 W motor produce if it is 60% efficient?

total eff.

$$eff = \frac{useful - ?}{total} \qquad .6 = \frac{P_{use}}{200} \qquad P_{use} = 120\ W$$

4. How much useful work does a 150 W motor due in 2 mins? 120sec

$$P = \frac{W}{t} \rightarrow W = P \cdot t = (150)(120) = 18{,}000\ J$$

5. How long does it take for a 70% efficient 120W motor to lift a 5 kg box 55 m straight up?

① $Eff = \frac{useful - ?}{total}$

$.70 = \frac{useful\ Power}{120}$

useful power = 84 W

② $P = \frac{W}{t}$ — $F \cdot d = (5)(9.8)(55) = 2695\ J$

84 W

?

$84 = \frac{2695}{t}$

$t = 2695/84 = 32.1\ sec.$

6. A 120 Watt motor takes 20 seconds to lift a 10 kg mass up 11 m. How efficient is the motor?

total power.

① useful Power $= \frac{W}{t} = \frac{F_g \cdot d}{t} = \frac{(10)(9.8)(11)}{20}$

useful Power $= 53.9\ W$.

② $Eff = \frac{useful}{total} = \frac{53.9}{120}$

$= 45\%$

7. A 200 W motor drags a 120 N box across a desk 5 m in 9 seconds. The coefficient of friction between the desk box and the desk is 0.44 How efficient is the motor?

total power.

① $W = F \cdot d = F_f \cdot d$

μF_g

$W = (.44)(120)(5) = 264\ J.$

② $P = W/t$

$= \frac{264}{9}$

$= 29.3\ W$

③ $Eff = \frac{useful}{total} = \frac{29.3}{200}$

$= 14.6\%$

8. How much power is needed to get a 1000 kg car going from rest to 20 m/s in 7 seconds?

$P = \frac{W}{t} = \frac{\Delta KE}{t} = \frac{KE_f - KE_i}{t} = \frac{KE_f}{t} = \frac{\frac{1}{2}mv^2}{t} = \frac{\frac{1}{2}(1000)(20)^2}{7}$ ($KE_i = 0$)

$= 28,571 = 28,600$ Watts.

9. A 1500 kg car starts rolling (from rest) down a 43 m high hill. Assuming no energy is lost on the way down, how fast is the car going at the bottom?

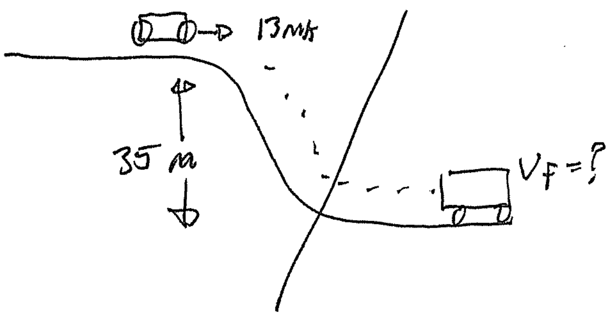
$$E_i = E_f$$

$$PE_i = KE_f$$

$$\cancel{m}gh = \frac{1}{2}\cancel{m}v^2$$

$$(9.8)(43) = \frac{1}{2}(v)^2 \qquad v = 29.0 \text{ m/s}$$

10. A 2000 kg truck is going 13 m/s and then rolls down a 35 m high hill. Assuming no energy is lost on the way down, how fast is the truck going at the bottom?



$$PE_i + KE_i = KE_f$$

$$\cancel{m}gh + \frac{1}{2}\cancel{m}v^2 = \frac{1}{2}\cancel{m}v^2$$

$$(9.8)(35) + \left(\frac{1}{2}\right)(13)^2 = \frac{1}{2}(v)^2$$

$$427.5 = \frac{1}{2}v^2$$

$$v = 29.2$$

11. A 1300 kg car going 140 km/hr starts up a very tall hill. What is the maximum height the car reaches, assuming that 400,000 J of energy are converted to heat?

38.8 m/s

$$KE_i = PE + \text{HEAT}$$

$$\frac{1}{2}(1300)(38.\bar{8})^2 = (1300)(9.8)h + 400{,}000$$

$$582{,}979 = (1300)(9.8)h$$

$$\boxed{h = 45.8 \text{ m}}$$