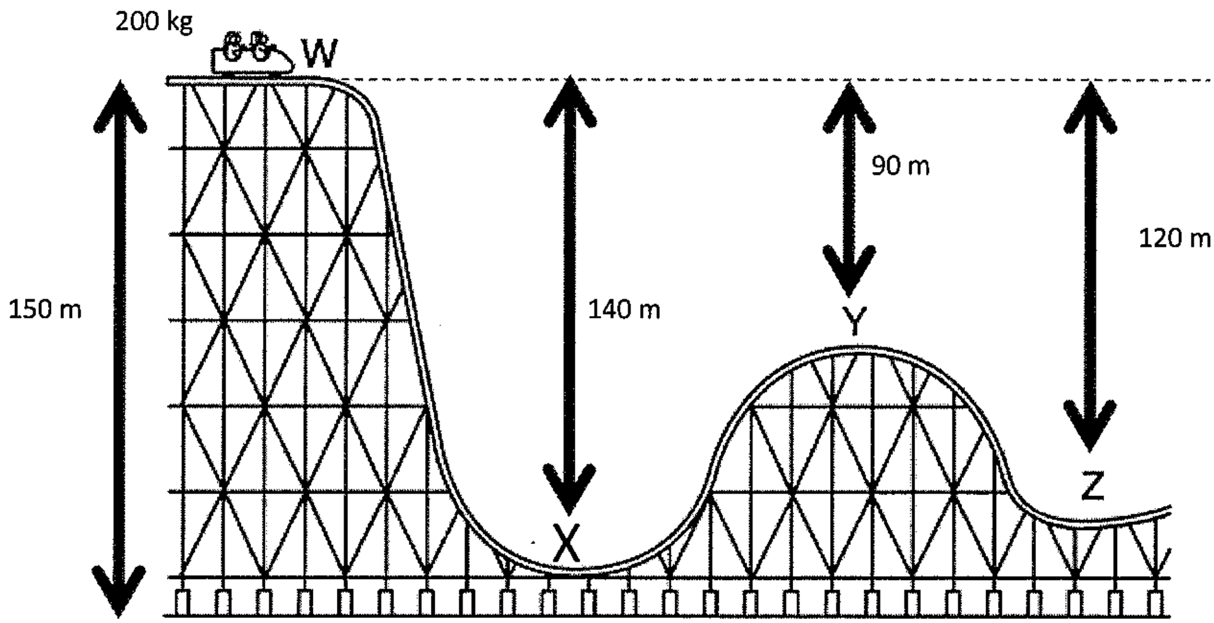
UCONN Physics 1201Q
Roller Coaster Energy Wkst I
Practice Quiz A-D   / 60

Name: KEY
Date: _______ Period _____



Part I: Calculations <u>without</u> Friction

<u>Formula's:</u> Work = F D cosθ   Work = ½ kx^2 PE = mgh   KE = ½ mv^2 Power = work/time $F_{fr} = \mu F_N$

Energy gained/lost at Point "W" = Energy gained/lost @ point "X", "Y", or "Z" + [Frictional work]

Δ [mgh + ½ mv^2] = Δ [mgh + ½ mv^2] + [$F_{fr} \bullet D$]

1. Calculate the PE at all points: *Answers: [W=294,000J; X=19,600J; Y=117,600J; Z=58,800J] (1 pt. each)*

W: $PE = mgh = 200\,kg\,(9.8\,m/s^2)(150\,m) =$ Ans: 294,000 J

X: $PE = mgh = 200\,kg\,(9.8\,m/s^2)(10\,m) =$ Ans: 19,600 J

Y: $PE = mgh = 200\,kg\,(9.8\,m/s^2)(60\,m) =$ Ans: 117,600 J

Z: $PE = mgh = 200\,kg\,(9.8\,m/s^2)(30\,m) =$ Ans: 58,800 J

2. Calculate the Velocity at all points: *Answers: [X=52.38 m/s; Y=42 m/s; Z=48.5 m/s] (2 pts. each)*

X: $mgh_w + \frac{1}{2}mV_w^2 = mgh_x + \frac{1}{2}mV_x^2$ Ans: 52.38 m/s

$mgh_w - mgh_x = \frac{1}{2}mV_x^2$ $V_x = \sqrt{2[(gh_w) - (gh_x)]}$

$gh_w - gh_x = \frac{1}{2}V_x^2$ $V_x = 52.38\,m/s$

Y: Ans: 42 m/s

$mgh_w + \frac{1}{2}mV_w^2 = mgh_y + \frac{1}{2}mV_y^2$

$mgh_w - mgh_y = \frac{1}{2}mV_y^2$ $V_y = \sqrt{2[(gh_w) - (gh_y)]}$

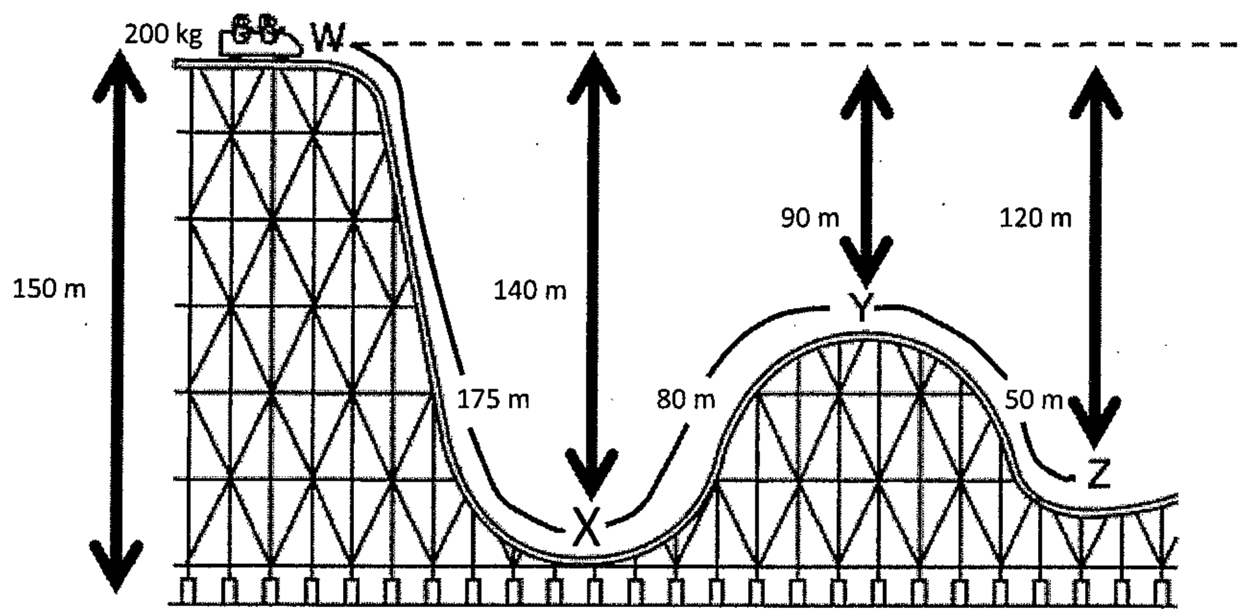
$gh_w - gh_y = \frac{1}{2}V_y^2$ $V_y = 42\,m/s$

Z: Ans: 48.5 m/s

$mgh_w + \frac{1}{2}mV_z^2 = mgh_z + \frac{1}{2}mV_z^2$

$mgh_w - mgh_z = \frac{1}{2}mV_z^2$ $V_z = \sqrt{2[(gh_w) - (gh_z)]}$

$gh_w - gh_z = \frac{1}{2}V_z^2$ $V_z = 48.5\,m/s$



Part II: Calculation with Friction: Force of Friction is 350 N.

3. Calculate the Velocity at all points: *Answers:* *[X=46.17 m/s; Y=29.52 m/s; Z=35.84 m/s]* (10 pts. Each)

X: $mgh_w + \frac{1}{2}mv_w^2 = mgh_x + \frac{1}{2}mv_x^2 + (F_{fr} \cdot D)$ Ans: 46.17 m/s

$200\,kg(9.8\,m/s^2)(150\,m) + 0 = 200\,kg(9.8\,m/s^2)(10\,m) + \frac{1}{2}\,200\,kg\,V_x^2 + (350\,N \cdot 175\,m)$

$294{,}000\,J = 19{,}600\,J + 100\,kg\,V_x^2 + 61250\,J$

$213{,}150\,J = 100\,kg\,V_x^2$ $\boxed{V_x = 46.17\,m/s}$

Y: Ans: 29.52 m/s

$mgh_w + \frac{1}{2}mv_w^2 = mgh_y + \frac{1}{2}mv_y^2 + (F_{fr} \cdot D)$

$200\,kg(9.8\,m/s^2)(150\,m) + 0 = 200\,kg(9.8\,m/s^2)(60\,m) + \frac{1}{2}\,200\,kg\,V_y^2 + (350\,N \cdot 255\,m)$

$294{,}000\,J = 117600\,J + 100\,kg\,V_y^2 + 89{,}250\,J$

$87{,}150\,J = 100\,kg\,V_y^2$ $\boxed{V_y = 29.52\,m/s}$

Z: Ans: 35.84 m/s

$mgh_w + \frac{1}{2}mv_w^2 = mgh_z + \frac{1}{2}mV_z^2 + (F_{fr} \cdot D)$

$200\,kg(9.8\,m/s^2)(150\,m) + 0 = 200\,kg(9.8\,m/s^2)(30\,m) + \frac{1}{2}\,200\,kg\,V_z^2 + (350\,N \cdot 305\,m)$

$294{,}000\,J = 58{,}800\,J + 100\,kg\,V_z^2 + 106750\,J$

$128{,}450\,J = 100\,kg\,V_z^2$ $\boxed{V_z = 35.84\,m/s}$

[illegible]