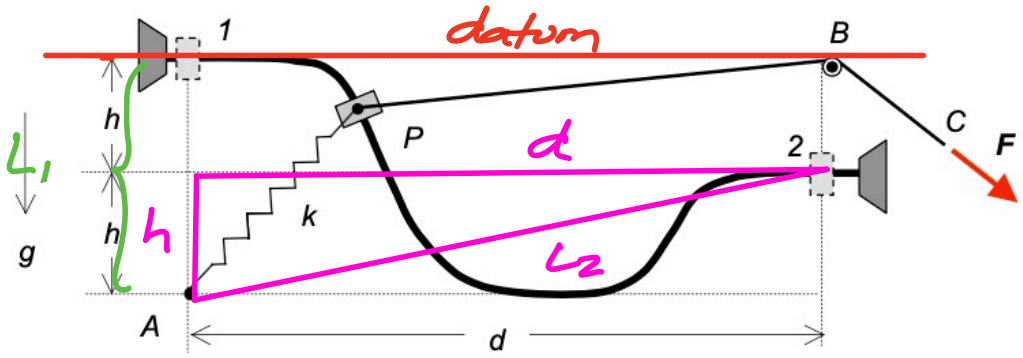
ME 274 – Fall 2024 – Quiz 7 **Name** SOLUTION

Particle P of mass *m* being pulled along a rough (not smooth), curvy surface by force *F* from Position 1 to Position 2. The spring is unstretched at Position 1.



Question Q1

Spring potential energy at position 2, $(V_2)_{sp}$:

a) $(V_2)_{sp} = \frac{1}{2}kd^2$

b) $(V_2)_{sp} = \frac{1}{2}kh^2$

c) $(V_2)_{sp} = \frac{1}{2}k(d-2h)^2$

d) $(V_2)_{sp} = \frac{1}{2}k\left(d^2-4h^2\right)$

e) $(V_2)_{sp} = \frac{1}{2}k\left(\sqrt{d^2+h^2}-2h\right)^2$

f) more information is needed about the shape of the guide in order to determine $(V_2)_{sp}$.

$L_2 = \sqrt{L_1^2+d^2} = \sqrt{d^2+h^2}$

$\Delta_2 = \frac{1}{2}k(L_2-L_1)^2$

$= \frac{1}{2}k\left(\sqrt{d^2+h^2}-2h\right)^2$

Question Q2

Work done by friction, $U_{1\to2}^{(f)}$:

a) $U_{1\to2}^{(f)} > 0$

b) $U_{1\to2}^{(f)} = 0$

c) $U_{1\to2}^{(f)} < 0$

d) more information is needed about the shape of the guide in order to determine the sign of $U_{1\to2}^{(f)}$.

$U_{1\to2}^{(f)} = \int (\underbrace{\vec{f}\cdot\vec{e}_t}_{-f})\,ds = -\int f\,ds$

Question Q3

Change in gravitational potential, $\Delta V_{gr} = (V_2)_{gr} - (V_1)_{gr}$:

a) $\Delta V_{gr} > 0$

b) $\Delta V_{gr} = 0$

c) $\Delta V_{gr} < 0$

d) more information is needed about the shape of the guide in order to determine the sign of ΔV_{gr}.

$\Delta V_{gr} = V_2 - V_1 = -mgh$

Question Q4

Speed of P at position 2, v_2, as compared to the speed at position 1, v_1:

a) $v_2 > v_1$

b) $v_2 = v_1$

c) $v_2 < v_1$

d) more information is needed about problem in order to compare v_1 and v_2.

- V_{sp} and ΔV_{gr} are path independent
- $U_{1\to2}^{(f)}$ is path dependent