A 15kg Block is lifted up by a student to the top of a 3m shelf is 10 seconds. After 1 minute on the shelf the box falls back down to the floor. Answer the following questions.

a. How much work is done by the student?

$$mgh = PE \ (U_g) \quad 15 \cdot 10 \cdot 3 = 450J$$

b. How much work is done by the shelf during the 1 minute the box spent on the shelf?

Zero

c. How much mechanical energy does the box have while on the shelf?

only $PE = 450J$

d. How fast it the box moving just before it reaches the ground?

$$PE = KE \quad 450 = \tfrac{1}{2}mv^2 \quad 450 = \tfrac{1}{2}(15)(v)^2$$

$$V = 7.7 \ m/s$$

e. Using energy calculate how much of each of these the box has when the box is 2 meters high.

- Potential Energy:

$$mgh = U \quad 15 \cdot 10 \cdot 2 = 300$$

- Kinetic Energy:

$$450 - 300 = 150$$

A bicycle and rider (100kg) rides at 5 m/s for 10 meters. The friction on the surface was 0.05 prior to a ramp. Which allowed the rider to jump vertically in the air? Answer the following questions.

a. How much energy was done by friction during the ride?

$$Mg \mu d = TE \quad 5 \cdot 10 \cdot .05 \cdot 10 = 25J$$

b. How much work is being done by the rider to maintain the speed of the bike at 5m/s?

$$25J$$

c. How high can the bike reach vertically?

$$KE \to PE \quad \tfrac{1}{2}mv^2 = Mgh \quad \frac{v^2}{2g} = h \quad \frac{5^2}{2 \cdot 10} = 1.25m \quad \uparrow \text{straight up}$$

d. If the biker only reaches a maximum vertical height of 0.25m, how fast is the bike going at this vertical point?

$$mgh = PE$$
$$100 \cdot 10 \cdot .25 = 250J$$
$$\begin{array}{r} 1250 \\ 250 \end{array}$$

Total Energy
$$\tfrac{1}{2}mv^2$$
$$\tfrac{1}{2}(100)(5)^2 = 1250J$$

$$\begin{array}{r} 250 \\ -100J \\ \hline \end{array}$$ left over

$$KE = \tfrac{1}{2}mv^2$$
$$1000 = \tfrac{1}{2}(100)v^2$$
$$V = 4.47 \ m/s$$