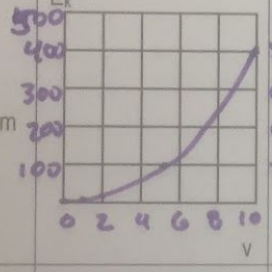
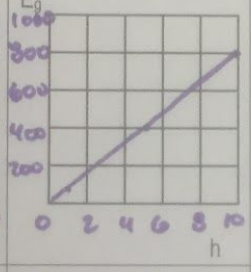
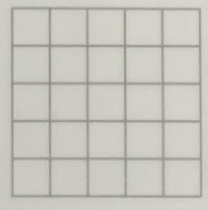
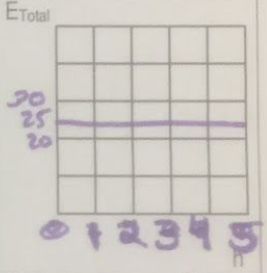
KEY

Complete the representations for the four patterns below.

Pattern with "A" value	- Motion Energy - Kinetic Energy vs velocity mass = 8 kg	Potential Energy Eg vs height mass = 8 kg	Elastic Energy in a Spring E_e vs Stretch Spring constant (k) = 5 N/m	Total Energy for a Jump E_T vs height Use Info in Data Table
Mathematical Model	$E_k = \frac{1}{2}mv^2$	$E_g = mgh$	$E_{elastic} =$ Y	$E_{Total} = 25$ Joules
Data Table Form	V | E_k 1 | 4 2 | 16 5 | 100 10 | 400	h | E_g 1 | 80 2 | 160 5 | 400 10 | 800	Stretch | E_e 1 | 2 | 5 | 10 |	h | E_g | E_k | E_e | E_T 5 | 25 | 0 | 0 | 25 2 | 20 | 5 | 0 | 25 1 | 10 | 6 | 9 | 25 0 | 0 | 0 | 25 | 25
Graph Form				
In words	As velocity doubles, kinetic energy quadruples.	As height doubles, Gravitational Potential Energy doubles.		As the height changes the total Energy in the system stays constant

a-value $\frac{1}{2}m$ mg

Compare and Contrast important aspects of E_k and E_g:

5. Compare: both equations include mass

6. Contrast E_k is quadratic, E_g is linear

7. **Ranking Task:** Rank the vehicles in order of total energy:

LEAST a. a Tesla Roaster (2000 kg) speeding 40 m/s down a closed track at sea level. 1,600,000 J.

MOST b. a semi-truck (10000 kg) pulled off at a rest stop 60 above sea level. 6,000,000 J

c. a Cadillac (2500 kg) cruising down a highway 20 m/s at 20 m above sea level. 1,000,000 J

KEY

a) Tesla

$m = 2000$ kg

$V = 40$ m/s

$h = 0$

$E_T = E_g + E_k = \cancel{mgh}^{\,0} + \frac{1}{2}mv^2$

$E_T = \frac{1}{2}mv^2 = \frac{1}{2}(2000)\,40^2$

$= 1{,}600{,}000$ Joules

b) Semi truck

$m = 10{,}000$ kg

$h = 60$ m

$V = 0$ m/s

$E_T = E_g + E_{ke} = mgh + \cancel{\frac{1}{2}mv^2}^{\,0}$

$E_T = mgh = 10{,}000 \cdot 10 \cdot 60 = 6{,}000{,}000$ J.

c) Cadillac

$m = 2500$ kg

$V = 20$ m/s

$h = 20$ m

$E_T = E_g + E_k = mgh + \frac{1}{2}mv^2$

$= 2500 \cdot 10 \cdot 20 + \frac{1}{2} \cdot 2500 \cdot 20^2$

$= 500{,}000 + 500{,}000 = 1{,}000{,}000$ Joules