ABRHS PHYSICS (H) NAME: KEY

Multiple Springs

Problems:

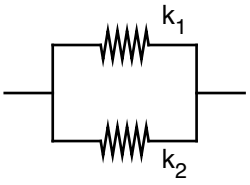
Determine the effective spring constant for each of the following (all spring constants are given in N/m.):

1. $k_1 = 50$ & $k_2 = 75$

$\frac{1}{k_e} = \frac{1}{50} + \frac{1}{75} = \frac{5}{150}$

$\frac{1}{k_e} = \frac{1}{30}$ → $k_e = 30$ N/m

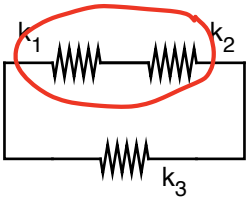
2. $k_1 = 50$ & $k_2 = 75$



$k_e = 50 + 75$

$= 125$ N/m

3. $k_1 = 10$ & $k_2 = 30$ & $k_3 = 20$



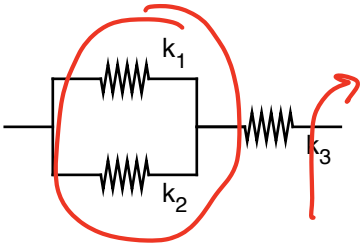
$\frac{1}{k_e} = \frac{1}{10} + \frac{1}{30} = \frac{4}{30} = \frac{2}{15}$

$\therefore k_e = 7.5$

Then $k_e = 7.5 + 20$

$k_e = 27.5$ N/m

4. $k_1 = 100$ & $k_2 = 200$ & $k_3 = 100$



$k_e = 100 + 200$

$= 300$ N/m

Then $\frac{1}{k_e} = \frac{1}{300} + \frac{1}{100}$

$\frac{1}{k_e} = \frac{4}{300} = \frac{1}{75}$

$k_e = 75$ N/m

5. Imagine you have three identical springs, each with a spring constant of 10 N/m. Using all three springs, what is the largest effective spring constant you could make?

All in parallel, so $k_e = 10 + 10 + 10 =$ 30 N/m

6. Imagine you have three identical springs, each with a spring constant of 10 N/m. Using all three springs, how could you make an effective spring constant of 15 N/m?

The top 2 are in series: $\frac{1}{k_e} = \frac{1}{10} + \frac{1}{10}$

$k_e = 5$

Then that is in parallel with the third

So $k_e = 5 + 10 =$ 15 N/m

7. Imagine you have three identical springs, each with a spring constant of 10 N/m. Could you make an effective spring constant that was less than 10 N/m? (If yes, show how and give result.)

Connect in series! So $\frac{1}{k_e} = \frac{1}{10} + \frac{1}{10} + \frac{1}{10} = \frac{3}{10}$

So $k_e = \frac{10}{3}$ N/m

Answers: *1) 30 n/m* *2) 125 N/m* *3) 27.5 N/m* *4) 75 N/m*

5) 30 N/m, all in parallel *6)*  *7) 3.33 N/m, all in series*