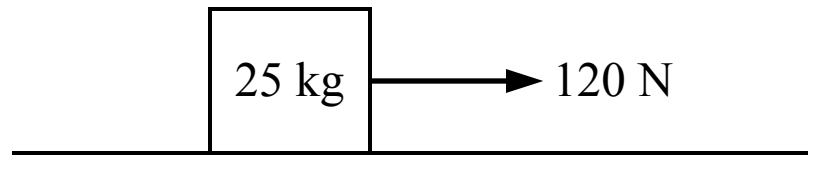
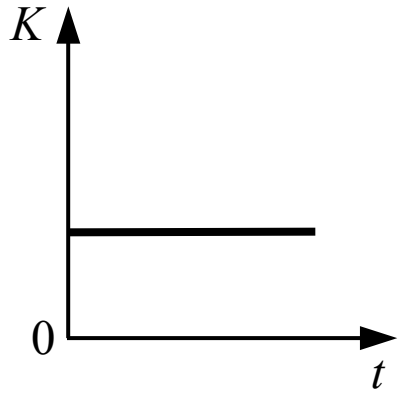
TYPES OF ENERGY



1. A block is sitting at rest on a floor when a 120 N force is exerted on the block. The coefficients of static friction and kinetic friction between the block and the floor are $\mu_s = 0.6$ and $\mu_k = 0.4$. Which of the following graphs shows the kinetic energy of the block after the 120 N force is applied?

(A)


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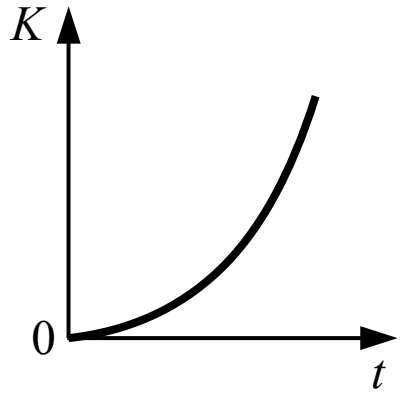
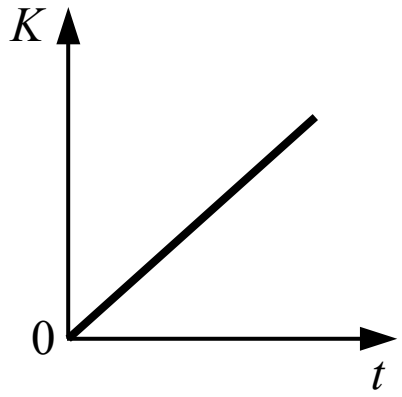


(C)


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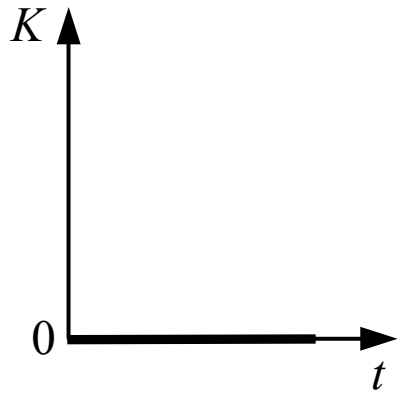
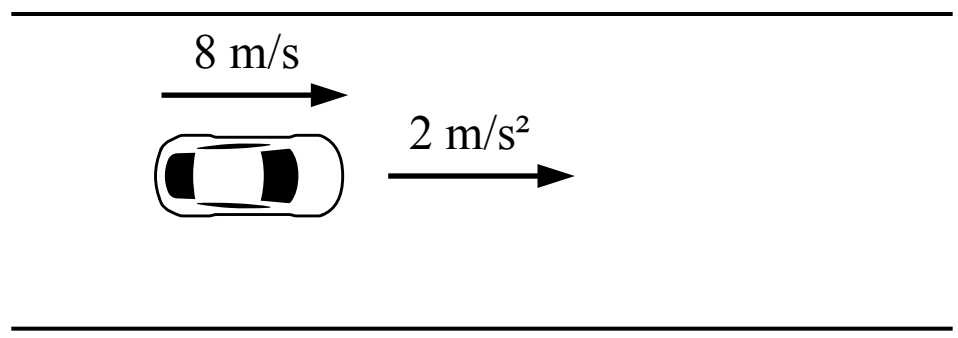
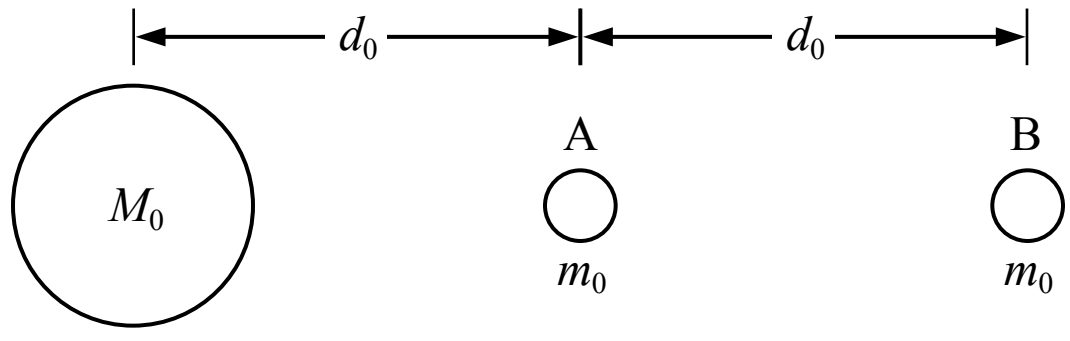




2. A 1500 kg car is driving at a speed of 8 m/s. It then accelerates at 2 m/s² for a period of 3 seconds. The kinetic energy of the car after that period is most nearly

(A) 147 kJ
(B) 48 kJ
(C) 27 kJ
(D) 14 kJ



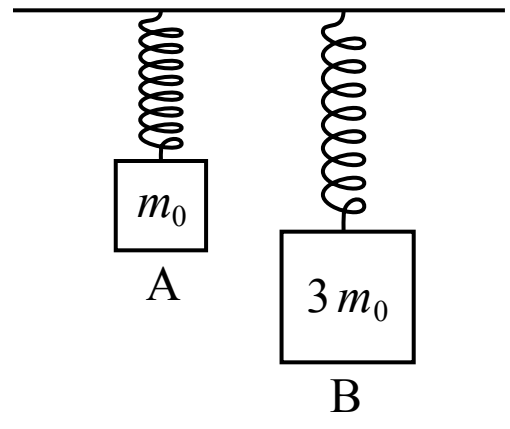
3. A planet has two moons which have the same mass and are located at the positions shown in the figure above. Which system, consisting of the planet and either one of the moons, has a greater gravitational potential energy?

   (A) The planet-moon A system has a greater gravitational potential energy

   (B) The planet-moon B system has a greater gravitational potential energy

   (C) The systems have the same gravitational potential energy

   (D) Cannot be determined



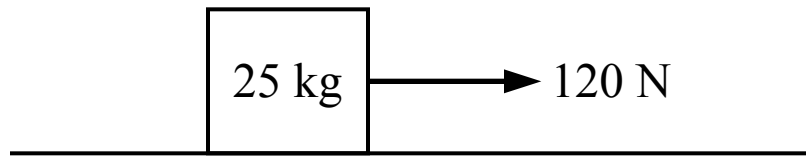
4. Two identical springs are suspended from the ceiling and then two blocks with different masses are attached to the bottom of the springs. How does the spring potential energy of the spring-block A system, $U_{\text{sp A}}$, compare to the spring potential energy of the spring-block B system, $U_{\text{sp B}}$?

   (A) $U_{\text{sp B}} = 9\,U_{\text{sp A}}$

   (B) $U_{\text{sp B}} = 3\,U_{\text{sp A}}$

   (C) $U_{\text{sp B}} = U_{\text{sp A}}$

   (D) $U_{\text{sp B}} = U_{\text{sp A}} / 3$



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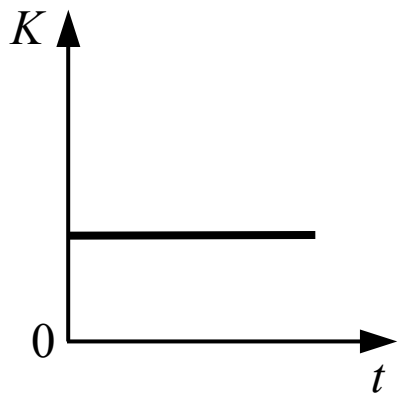

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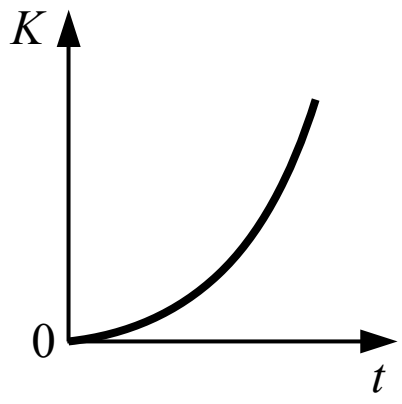
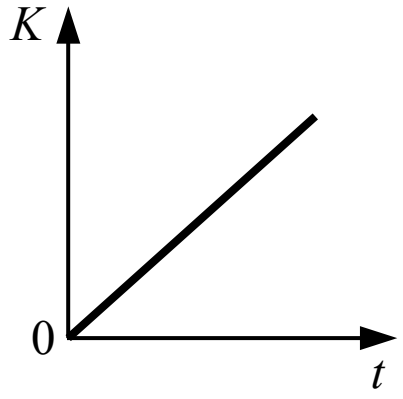


(C)


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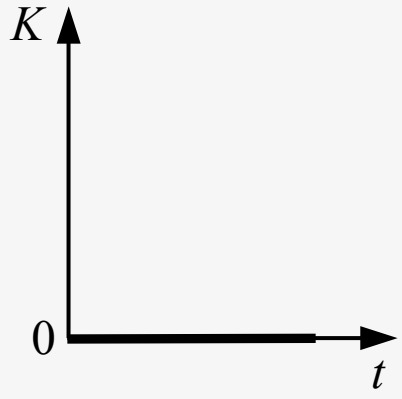
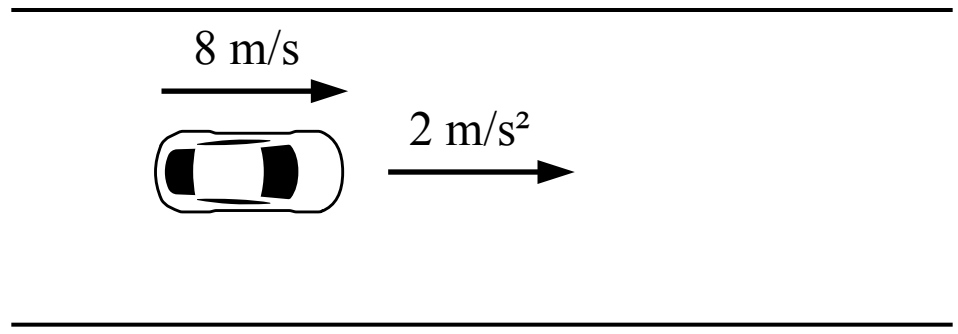


A Incorrect

B Incorrect
This answer would be correct if the applied force was greater than the maximum static friction force. The block would accelerate and the kinetic energy is proportional to the square of the speed.

C Incorrect

D Correct
The maximum static friction force between the block and the floor is greater than the applied 120 N force so so the block remains at rest and has no kinetic energy.
$\Sigma F_y = F_n - mg = m(0\ \text{m/s}^2) \qquad F_n = mg$
$f_{s\,max} = \mu_s F_n = (0.6)(25\ \text{kg})g = 150\ \text{N}$



2. A 1500 kg car is driving at a speed of 8 m/s. It then accelerates at 2 m/s² for a period of 3 seconds. The kinetic energy of the car after that period is most nearly

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A **Correct**

The final speed of the car can be found using a kinematic equation, then the final speed can be used to calculate the final kinetic energy of the car.

$$v_f = v_i + at = (8\ \text{m/s}) + (2\ \text{m/s}^2)(3\ \text{s}) = 14\ \text{m/s}$$

$$K = \frac{1}{2}mv^2 = \frac{1}{2}(1500\ \text{kg})(14\ \text{m/s})^2 = 147\ \text{kJ}$$

B Incorrect

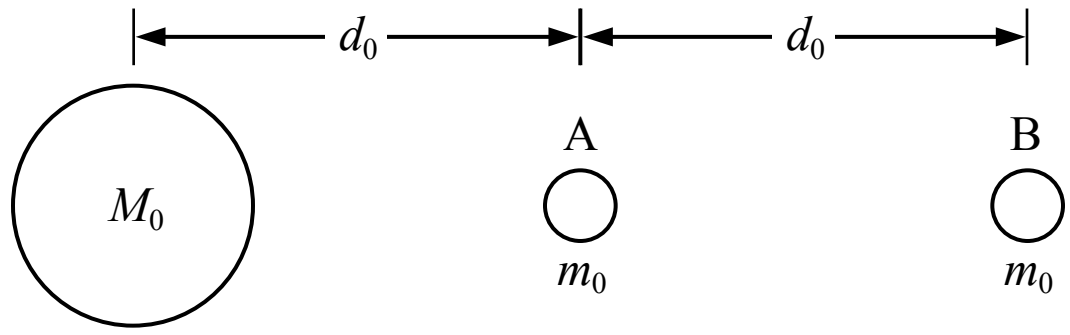
This answer incorrectly uses 8 m/s for the final speed of the car.

C Incorrect

This answer incorrectly uses 6 m/s for the final speed of the car.

D Incorrect

This answer is the value of the final speed of the car (14 m/s) with the units of kJ.



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A Incorrect

B Correct

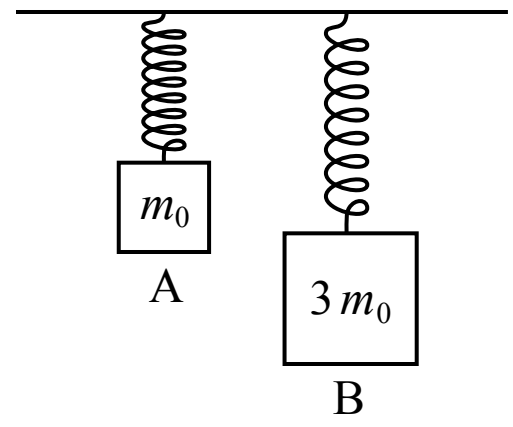
The gravitational potential energy of a two-mass system is given by the equation below. The gravitational potential energy is always negative. There is a greater distance between the planet and moon B so the value of r is greater and the gravitational potential energy is a smaller negative value (a value closer to zero) or a greater or more positive value than the gravitational potential energy of the planet-moon A system.

Planet-moon A system: $U_{gA} = -\frac{GMm}{r} = -\frac{GM_0 m_0}{d_0}$

Planet-moon B system: $U_{gB} = -\frac{GMm}{r} = -\frac{GM_0 m_0}{2\,d_0} > U_{gA}$

C Incorrect

D Incorrect



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(D) $U_{\text{sp B}} = U_{\text{sp A}} / 3$

A Correct

The spring potential energy depends on the spring constant (which is the same for each spring) and the displacement of the spring which depends on the force exerted on the spring. The blocks are assumed to be at rest so the net vertical force on each block is zero and the spring force is equal to the weight force. Block B has 3 times the mass of block A so the spring potential energy is 9 times greater.

$$\Sigma F_y = F_{\text{sp}} - mg = m(0\ \text{m/s}^2) \qquad F_{\text{sp}} = mg \qquad k\Delta x = mg \qquad \Delta x = \frac{mg}{k}$$

$$U_{\text{sp}} = \frac{1}{2}k\Delta x^2 = \frac{1}{2}k\left(\frac{mg}{k}\right)^2$$

B Incorrect

C Incorrect

D Incorrect