1. A force of 10 N pushes a box 3.0 m in the direction of the force. How much work is done?

   _____ J

2. A 2.0 kg book is lifted 5.0 m. How much gravitational PE does it gain? (Use $g = 9.81\ \frac{\text{m}}{\text{s}^2}$.)

   _____ J

3. A force acting at right angles to the motion does how much work?

   ☐ the most work

   ☐ negative work

   ☐ zero

   ☐ positive work

4. A 4.0 kg trolley moves at 3.0 $\frac{\text{m}}{\text{s}}$. What is its kinetic energy?

   _____ J

5. Friction on a sliding object does negative work.

   ☐ True ☐ False

6. As a ball rolls down a frictionless ramp, its gravitational PE turns mainly into:

   ☐ elastic potential energy

   ☐ kinetic energy

   ☐ thermal energy

   ☐ electrical energy

7. Energy cannot be created or destroyed, only _____ from one form to another.

   _____

8. A 2.0 kg block slides from rest down a smooth ramp, dropping 1.5 m in height. What is its speed at the bottom, in $\frac{\text{m}}{\text{s}}$? ($g = 9.81\ \frac{\text{m}}{\text{s}^2}$)

   _____

9. A machine takes in 200 J and gives out 60 J of useful energy. What is its efficiency (in %)?

   _____ %

10. In $mg\Delta h$ the height is the distance travelled along the slope.

    ☐ True ☐ False

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1. **30 J**

   Force is along the motion ($\theta = 0$), so $W = Fs = 10 \times 3.0 = 30$ J.

2. **98.1 J**

   $\Delta E_{\text{P}} = mg\Delta h = 2.0 \times 9.81 \times 5.0 \approx 98$ J.

3. **zero**

   $W = Fs\cos 90° = 0$. The normal contact force on a car on a flat road does no work.

4. **18 J**

   $E_{\text{K}} = \frac{1}{2}mv^2 = \frac{1}{2} \times 4.0 \times 3.0^2 = 18$ J.

5. **True**

   Friction points opposite to the motion ($\theta = 180°$), so $W = -Fs$ – it takes energy away.

6. **kinetic energy**

   With no friction, all the lost GPE becomes kinetic energy: $mgh = \frac{1}{2}mv^2$.

7. **transferred**

   That is conservation of energy – the total in a closed system stays the same.

8. **5.4**

   $mgh = \frac{1}{2}mv^2$, and the mass cancels: $v = \sqrt{2 \times 9.81 \times 1.5} = 5.4\ \frac{\text{m}}{\text{s}}$. Use the VERTICAL drop, never the distance along the ramp.

9. **30 %**

   $\frac{60}{200} \times 100\% = 30\%$. The other 140 J is wasted, mostly as heat.

10. **False**

    It is the VERTICAL height gained or lost. Using the slope distance always overestimates the energy change, by a factor of $\frac{1}{\sin\theta}$.