5. Work, energy and power

Starter Quiz · 课前小测

A-Level Physics Name: _____ Score: _____

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?

   ☐ zero

   ☐ positive work

   ☐ negative work

   ☐ the most 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:

   ☐ kinetic energy

   ☐ elastic potential energy

   ☐ thermal energy

   ☐ electrical energy

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

   _____

8. Kinetic energy written in terms of momentum p is:

   ☐ $\frac{p^2}{2m}$

   ☐ $\frac{p}{2m}$

   ☐ $\frac{2m}{p^2}$

   ☐ $\frac{mp^2}{2}$

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

   _____ %

10. A block slides into a spring on a frictionless surface. At greatest compression its kinetic energy has all become _____ potential energy.

    _____

5. Work, energy and power

Answers · 答案

A-Level Physics

1. **30 J**

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

2. **98.1 J**

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

3. **zero**

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

4. **18 J**

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

5. **True**

   Friction points opposite to the motion ($\theta = 180^\circ$), 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. $\dfrac{p^2}{2m}$

   From $p = mv$ and $E_{\mathrm{K}} = \frac{1}{2}mv^2$, substituting $v = p/m$ gives $E_{\mathrm{K}} = \dfrac{p^2}{2m}$.

9. **30 %**

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

10. **elastic**

    KE → elastic PE $= \frac{1}{2}kx^2$ at the point of greatest compression, then back to KE as the spring pushes it off.