1. A 4 kg object moves at 3 $\frac{\text{m}}{\text{s}}$. What is its kinetic energy (in J)?

   _____ J

2. A 10 N force pushes a box 4 m in the same direction. How much work is done (in J)?

   _____ J

3. Lift a 2 kg book 1.5 m ($g = 9.8$). How much gravitational potential energy is stored (in J)?

   _____ J

4. A ball is dropped from 2 m (no air resistance, $g = 10$). Its speed at the bottom (in m/s)?

   _____ m/s

5. A machine does 600 J of work in 3 s. What is its average power (in W)?

   _____ W

6. If a car's speed doubles, its kinetic energy becomes...

   ☐ four times

   ☐ the same

   ☐ double

   ☐ half

7. You carry a bag horizontally across a room. The work gravity does on the bag is...

   ☐ large and negative

   ☐ large and positive

   ☐ equal to the bag's weight

   ☐ zero

8. Friction has an associated potential energy, just like gravity.

   ☐ True ☐ False

9. When friction acts, the mechanical energy $K + U$ stays constant.

   ☐ True ☐ False

10. A more powerful motor always does more total work than a weaker one.

    ☐ True ☐ False

exercises.lol exercises.com.cn

1. **18 J**

   $K = \frac{1}{2}mv^2 = \frac{1}{2}(4)(9) = 18$ J.

2. **40 J**

   With $\theta = 0$, $W = Fd\cos 0 = 10 \times 4 \times 1 = 40$ J.

3. **29.4 J**

   $U_g = mgy = 2 \times 9.8 \times 1.5 = 29.4$ J.

4. **6.32 m/s**

   $mgh = \frac{1}{2}mv^2$, so $v = \sqrt{2gh} = \sqrt{2 \times 10 \times 2} = \sqrt{40} \approx 6.32$ $\frac{\text{m}}{\text{s}}$.

5. **200 W**

   $P = W/t = 600/3 = 200$ W.

6. **four times**

   $K \propto v^2$, so doubling v multiplies K by $2^2 = 4$.

7. **zero**

   Gravity points down, motion is horizontal – perpendicular, so $\cos 90° = 0$ and the work is zero.

8. **False**

   Only conservative forces have potential energy. Friction dissipates energy as heat – it cannot be stored.

9. **False**

   Friction is nonconservative – it drains mechanical energy into heat, so $K + U$ decreases.

10. **False**

    Power is a *rate*. Two motors can do identical total work; the more powerful one just finishes faster.