

- 17 Researchers have developed a new type of filament lamp with an efficiency of 40%. Old-type filament lamps have an efficiency of 5.0%. The two types of lamp produce the same useful output power.

What is the ratio $\frac{\text{input power to new type of lamp}}{\text{input power to old type of lamp}}$?

- A 0.13 B 0.63 C 1.6 D 8.0

- 18 A student attempts to derive the formula for kinetic energy E_k . She begins by considering an object of mass m which is initially at rest. A constant force F applied to the object causes it to accelerate to final velocity v in displacement s . The kinetic energy gained by the object is equal to the work done on the object by the force F .

Which equation would the student **not** need in order to derive the formula for E_k ?

- A $F = ma$ B $W = Fs$ C $E = \frac{1}{2}Fs$ D $v^2 = u^2 + 2as$

- 19 A metal wire obeys Hooke's law and has a Young modulus of 2.0×10^{11} Pa. The wire has an original length of 1.6 m and a diameter of 0.48×10^{-3} m.

What is the spring constant of the wire?

- A $7.2 \times 10^3 \text{ N m}^{-1}$
B $2.3 \times 10^4 \text{ N m}^{-1}$
C $2.9 \times 10^4 \text{ N m}^{-1}$
D $9.0 \times 10^4 \text{ N m}^{-1}$

- 20 A wire is being stretched by a tensile force.

Which statement about the elastic limit **must** be correct?

- A The deformation is plastic after the elastic limit has been reached.
B The deformation is plastic until the elastic limit is reached.
C The extension is proportional to the tensile force after the elastic limit has been reached.
D The extension is proportional to the tensile force until the elastic limit is reached.

- 21 Which statement is correct for **all** types of progressive wave?

- A The distance from a peak to the next trough is equal to a wavelength.
B They can be demonstrated in ripple tanks.
C They consist of vibrating atoms.
D They transfer energy from one position to another.