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.