Kinetic + Potential Energy Practice Key

#15 $E_k = ?$
$m = 1000\,kg$
$v = 20.0\,m/s$

$$E_k = \frac{mv^2}{2} = \frac{1000\,kg \cdot 20.0^2\,m/s}{2}$$

$$= 200{,}000\,J \quad (kg \cdot m^2/s^2)$$

* this is a good check in Physics! Units should work.

#16 $E_k = ?$
$m = 1000\,kg$
$v = 40.0\,m/s$

$$E_k = \frac{mv^2}{2} = \frac{1000\,kg \times (40.0\,m/s)^2}{2}$$

$$= 8000\,J$$

*Joul is a compound unit $= kg \cdot m^2/s^2$

#17 $E_k = 15{,}000\,J$
$m = 50\,kg$
$v = ?$

$$v = \sqrt{\frac{2E_k}{m}} = \sqrt{\frac{2 \cdot 15000\,J}{50\,kg}} = 24.4948\,m/s$$

$$= 24\,m/s$$

#18 $m = 3.0\,kg$
$\Delta h = 0.45\,m$
$E_g = ?$
$g = 9.8\,m/s^2$

$$E_g = m \cdot g \cdot \Delta h$$
$$= 3.0\,kg \cdot 9.8\,m/s^2 \cdot 0.45\,m$$
$$= 13.23\,kg \cdot m^2/s^2$$

$$= 13\,J$$

#19 $m = 75\,kg$
$\Delta h = 300\,m$
$g = 9.8\,m/s^2$
$E_g = ?$

$$E_g = m \cdot g \cdot \Delta h$$
$$= 75\,kg \cdot 9.8\,m/s^2 \cdot 300\,m$$
$$= 220{,}500\,kg \cdot m^2/s^2$$
$$= 220{,}000\,J$$

≈ 2 sig fig

#20 $E_g = 14000\,J$
$m = 40\,kg$
$\Delta H = ?$
$g = 9.8\,m/s^2$

$$\Delta H = \frac{E_g}{m \cdot g} = \frac{14000\,J}{40\,kg \cdot 9.8\,m/s^2}$$

$$= 36\,m$$

#21) $m = 21\ kg$
$v = 30\ m/s$
$E_K = ?$

$E_K = \frac{m \cdot v^2}{2} = \frac{21\ kg \cdot (30\ m/s)^2}{2}$

$= \boxed{945\ J}$

#22) $\Delta h = 21\ m$
$m = 12\ N = 1.2\ kg$
$g = 9.8\ m/s^2$
$E_g = ?$

$1\ N = 0.10197\ kg$
conversion factor

$12\ N \times \frac{0.10197\ kg}{1\ N} = 1.2\ kg$

$E_g = m \cdot g \cdot \Delta h$
$= 1.2\ kg \times 9.8\ m/s^2 \cdot 21\ m$
$= 246.96\ J$
$\boxed{= 250\ J}$

#23) $v = 40\ m/s$
$m = 1120\ kg$
$E_K = ?$

$E_K = \frac{m \cdot v^2}{2}$
$= \frac{1120\ kg \cdot (40\ m/s)^2}{2}$
$= \boxed{896000\ J}$ or $\boxed{900,000\ J}$
either is fine

#24) $\Delta h = 20\ m$
$m = 8.1\ kg$
$E_g = ?$
$g = 9.8\ m/s^2$

$E_g = m \cdot g \cdot \Delta h$
$= 8.1\ kg \cdot 9.8\ m/s^2 \cdot 20\ m$
$= 1587.6\ J$
$= \boxed{1600\ J}$

#25) $\Delta h = 45\ m$
$m = 19\ kg$
$E_g = ?$
$g = 9.8\ m/s^2$

$E_g = m \cdot g \cdot \Delta h$
$= 19\ kg \cdot 9.8\ m/s^2 \cdot 45\ m$
$= 8379\ kg\ m^2/s^2$
$\boxed{= 8400\ J}$

Remember $J = kg \cdot m^2/s^2$
and sig. fig.

26) $\Delta h = 72\,m$
$m = 100\,kg$
$E_g = ?$
$g = 9.8\,m/s^2$

$E_g = m \cdot g \cdot \Delta h$
$= 100\,kg \cdot 9.8\,m/s^2 \cdot 72\,m$
$= 70{,}560\,J$
$= \boxed{71000\,J}$

#27) $E_k = ?$
$m = 3\,kg$
$v = 2\,m/s$

$E_k = \frac{m \cdot v^2}{2}$
$= \frac{3 \cdot 2^2}{2} = \boxed{6\,J}$

#28) $m_1 = 2\,kg$ $m_2 = 4\,kg$
$v_1 = 2\,m/s$ $v_2 = 3\,m/s$

a) $E_k = \frac{m \cdot v^2}{2}$
$= \frac{2 \cdot 2^2}{2}$
$= 4\,J$

$E_k = \frac{mv^2}{2}$
$= \frac{4 \cdot 3^2}{2}$
$= 18\,J$

The 4kg object had more E_k

b) $\Delta h = 10m$ $\Delta h = 10m$

$E_g = m \cdot g \cdot \Delta h$
$= 2 \cdot 9.8 \times 10$
$196\,J$

$E_g = m \cdot g \cdot \Delta h$
$= 4 \cdot 9.8 \cdot 10$
$= 392\,J$

The 4kg object also has more E_g

Let's Try More

1) $m = 54\,kg$ (2 sig fig)
$\Delta h = 0.42\,km$ (2 sig fig) $\leftarrow$ $0.42\,km \times \frac{1000\,m}{1\,km} = 420\,m$
$E_g = ?$
$g = 9.8\,m/s^2$

$E_g = m \cdot g \cdot \Delta h = 54\,kg \cdot 9.8\,m/s^2 \times 420\,m$
$= 222{,}656\,J = \boxed{220{,}000\,J}$ (2 sig fig)

2) $m = 689\,kg$

$V = 27000\,km/h$

$E_K = ?$

$$\frac{27000\,km}{hr} \times \frac{1\ hr}{3600\ sec} \times \frac{1000\ m}{1\ km}$$

$V = 7500\,m/s$

$$E_K = \frac{m \cdot V^2}{2}$$

$$= \frac{689\,kg \times (7500\,m/s)^2}{2} = 1.9 \times 10^{10}\,J$$

$= 19000000000\,J$

3) $V = 2.8\,m/s$

$E_K = 25.5\,J$

$m = ?$

$$m = \frac{2E_K}{V^2} = \frac{2 \cdot 25.5\,J}{(2.8\,m/s)^2} = \boxed{6.5\,kg}$$

but $6.5\,kg \times \frac{1\ lb}{0.4536\,kg} = 14.34\,lb = \boxed{14\,lb}$

4) $m = 65\,kg$

$V = 90\,km/hr$

$g = 9.8\,m/s^2$

$\Delta h =$

$$E_K = \frac{m \cdot V^2}{2}$$

$$= \frac{65\,kg \times (25\,m/s)^2}{2} = 20{,}000\,J$$

$= 20312.5\,J$

$$\frac{90\,km}{1\,hr} \times \frac{1\,hr}{3600\,s} \times \frac{1000\,m}{1\,km} = 25\,m/s$$

$E_K = E_g$ * Energy Transforms

$E_g = m \cdot g \cdot \Delta h$

$20000\,J = 65\,kg \cdot 9.8\,m/s^2 \cdot \Delta h$

$$\Delta h = \frac{E_g}{m \cdot g} = \frac{20000\,J}{65\,kg \cdot 9.8\,m/s^2} = \frac{20{,}308\,J}{6.632}$$

$= 3000\,m$ or $3063\,m$

? when to round !

wait until end! $\boxed{3100\,m}$