1) 1		7) 8		6) 16 lux	
2) 6		8) 8		8) $\frac{\pi}{3}$, $V=\frac{\pi}{3}r^2h$	
3) 12		9) .5		10) 20.6 L	
4) 18		10) ±6		11) 378 kg	
5) 36		2) 15 Ω		12) 9:4	
6) 1.5		4) 0.125 mho			

---

4) $P = \frac{k}{\sqrt{q}}$ $P = \frac{72}{\sqrt{q}}$

$12 = \frac{k}{\sqrt{36}}$ $P = \frac{72}{\sqrt{16}}$

$72 = k$ $\boxed{P = 18}$

6) $w = kuv$ $w = 6uv$

$24 = k(.8)(5)$ $18 = 6u \cdot 2$

$6 = k$ $\boxed{k = \frac{3}{2}}$ $\frac{18}{12} = u$

7) $z = \frac{kuv}{w}$

$.8 = \frac{k \cdot 8 \cdot 6}{5}$

$4 = k \cdot 48$

$\frac{1}{12} = k$

$z = \frac{1 \cdot 3 \cdot 10}{12 \cdot 5}$

$\boxed{z = \frac{1}{2}}$

---

2) By *Ohm's Law*, the current flowing in a wire is inversely proportional to the resistance of the wire. If the current is 5 amperes (*A*) when the resistance is 24 ohms (Ω), for what resistance will the current be 8*A*?

$I = \frac{k}{R}$

$24\left(5 = \frac{k}{24}\right)$

$120 = k$

Notice the constant of variation is 120.
120 volts is the standard power for
U.S. electrical power fixtures.

$I = \frac{120}{R}$

$\left(8 = \frac{120}{R}\right)R$

$\frac{8R}{8} = \frac{120}{8}$

$\boxed{R = 15 \, \Omega}$

---

4) The conductance of a wire varies directly as the square of the wire's diameter and inversely as its length. Fifty meters of wire with diameter 2 mm has conductance 0.12 mho (*mho*, which is "ohm" spelled backwards, is a unit of conductance). If a wire of the same material has length 75 m and diameter 2.5 mm, what is its conductance?

$C = \frac{k d^2}{\ell}$

$0.12 = \frac{k(2)^2}{50}$

$6 = k(4)$

$\frac{3}{2} = k$

$C = \frac{\boxed{\frac{3}{2}} d^2}{\ell}$

$C = \frac{3(2.5)^2}{2(75)}$

$C = \frac{18.75}{150}$

$= 0.125 \text{ mho}$

In problems 5 and 6, use the fact that the intensity of light, measured in *lux*, is inversely proportional to the square of the distance between the light source and the object illuminated.

$I = \frac{k}{d^2}$

6) A light hangs 4.8 ft above the center of a circular table 7.2 ft in diameter. If the illumination is 25 lux at the center of the table, what is it at the edge of the table?

$I = \frac{k}{d^2}$

$25 = \frac{k}{4.8^2}$

$576 = k$

$I = \frac{576}{d^2}$

$I = \frac{576}{6^2} = \boxed{16 \text{ lux}}$

$a^2 + b^2 = c^2$

$3.6^2 + 4.8^2 = c^2$

$6 = c$

(labels on diagram: 6' c, a, 4.8, b, 3.6)

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8) The volume of a cone varies jointly as the height and the square of the radius of the base. A cone of height 8 cm and base diameter 9 cm has volume 54π. Find the constant of variation and general formula for the volume of a cone.

$V = khr^2$ $V = \frac{\pi}{3}hr^2$

$54\pi = k \cdot 8\left(\frac{9}{2}\right)^2$

$54\pi = \frac{81}{4} \cdot 8 \cdot k$

$54\pi = 162k$

$\frac{54\pi}{162} = k$

$\frac{\pi}{3} = k$

10) The volume of a given mass of a gas varies directly as its absolute
temperature and inversely as its pressure. At 2ºC and 99 kPa, 4 g
of helium occupies 23.1 L. What is the volume of the helium at 27ºC
and 121 kPa?

275ºK

Absolute Temperature is measured in
degrees Kelvin. 0º C = 273 ºK

300ºK

$$V = \frac{kT}{P}$$

$$V = \frac{8.316 \cdot 300}{121}$$

$$23.1 = \frac{k \cdot 275º}{99}$$

$$2286.9 = 275k$$

$$8316 = k$$

$$\boxed{20.6 \text{ L}}$$

The load a beam with a rectangular cross section can support is jointly
proportional to the beam's width and the square of its depth and inversely
proportional to its length.

$$B = \frac{kwd^2}{\ell}$$

11) A beam 3 cm wide and 5 cm deep can support a load of 630 kg.
What load can it support when turned on its side?

$$630 = \frac{k \cdot 3 \cdot 5^2}{\ell}$$

$$\frac{630\ell}{75} = k$$

$$8.4\ell = k$$

$$B = \frac{(8.4\ell)5 \cdot 3^2}{\ell}$$

$$\boxed{B = 378 kg}$$

Leave the letter for lenght, *l*, in the
constant. Notice it will cancel out in the
next step!

The load a beam with a rectangular cross section can support is jointly proportional
to the beam's width and the square of its depth and inversely proportional to its
length.

12) One beam is half as wide, twice as long, and three times as deep as a
second beam. Find the ratio of the loads they can support.

$$B = \frac{kwd^2}{\ell}$$

$$B = \frac{k\left(\frac{1}{2}w\right)(3d)^2}{2\ell}$$

$$B = \frac{k\left(\frac{1}{2}w\right)9d^2}{2\ell} = \boxed{\frac{9}{4}} \frac{kwd^2}{\ell}$$