

Homework**Question 1.** $1.93 \times 10^4 kg/m^3$

$$19.3g/cm^3 \cdot \frac{1kg}{10^3g} \cdot \frac{10^6cm^3}{1m^3} = 1.93 \times 10^4 kg/m^3$$

Question 2. (a) $88ft/s$ (b) $9.7536m/s^2$ (c) $1.0 \times 10^3 kg/m^3$

(a)

$$60mph = 60mi/h \cdot \frac{5280ft}{1mi} \cdot \frac{1h}{3600s} = 88ft/s$$

(b)

$$32ft/s^2 \cdot \frac{30.48cm}{1ft} \cdot \frac{1m}{100cm} = 9.7536m/s^2$$

(c)

$$1.0g/cm^3 \cdot \frac{1kg}{10^3g} \cdot \frac{10^6cm^3}{1m^3} = 1.0 \times 10^3 kg/m^3$$

Question 3. About 3.6×10^5 tubes per year.

$$\approx 60000students \cdot \frac{1tubes/student}{2months} \cdot \frac{12months}{1year} = 3.6 \times 10^5 tubes/year$$

Question 4. 0.44621%

$$1 - \frac{\pi \times 10^7 seconds/year}{365.24days/year \cdot 24hours/day \cdot 3600seconds/hour} \times 100\% = 0.44621\%$$

Question 5. (a) $A_x = -6.0m$ (b) $|\vec{A}| = 11.32m$

(a)

$$A_x = -A_y \times \tan 32^\circ = -6.00m$$

(b)

$$|\vec{A}| = A_y \div \cos 32^\circ = 11.32m$$

Question 6. (a) $|\vec{A}| = \sqrt{29}$, $|\vec{B}| = \sqrt{10}$ (b) $(-4, -5)$ (c) $|\vec{C}| = \sqrt{41}$; Direction: $\tan^{-1}\frac{5}{4}$ (51.34°) counter-clockwise from the +x-axis**Question 7.** $\vec{A} \cdot \vec{B} = -1$, $|\vec{A} \times \vec{B}| = 17$

$$\begin{aligned}\vec{A} \cdot \vec{B} &= (5, 2) \cdot (1, -3) = 5 \times 1 + 2 \times (-3) = -1 \\ |\vec{A} \times \vec{B}| &= |(5, 2) \times (1, -3)| = |5 \times (-3) - 2 \times 1| = 17\end{aligned}$$

Question 8. $t = 4.406 \times 10^{17} sec$

$$\begin{aligned}v_{galaxy} &= \frac{d}{t} \Rightarrow \frac{d}{t} = H \cdot d \\ \Rightarrow t &= \frac{1}{H} = \frac{1}{70km/sec/Mpc} \cdot \frac{3.26 \times 10^6 light\ years}{1Mpc} \cdot \frac{9.4607 \times 10^{12} km}{1light\ years} = 4.406 \times 10^{17} sec\end{aligned}$$

Note. v is approx. constant in this situation.

Previous solution(wrong):

$$v_{galaxy} = d'(t) \Rightarrow \frac{d'(t)}{d(t)} = H \Rightarrow \int_0^{t_0} \frac{d'(t)}{d(t)} dt = \int_0^{t_0} H dt \Rightarrow \ln d(t_0) - \ln d(0) = H \cdot t_0$$