For all Division 1 & Division 2 students

You should use the following values in determining the answers on this test. If you use other values in calculating answers, you may obtain values that do not exactly match answer selections found on this test. You will then need to choose the answer on the test closest to your value.

acceleration due to gravity	g	$= 10 \ m/s^2$
gravitational constant	G	$= 6.7 \times 10^{-11} \ N \cdot m^2/kg^2$
mass of the Earth	M_E	$= 6.0 \times 10^{24} \ kg$
radius of the Earth	R_E	$= 6.4 \times 10^6 \ m$
atomic mass unit	$1 \ u$	$= 1.7 \times 10^{-27} \ kg = 9.3 \times 10^2 \ MeV/c^2$
electron volt	$1 \ eV$	$= 1.6 \times 10^{-19} \ J$
rest mass of electron	m_e	$= 9.1 \times 10^{-31} \ kg$
rest mass of proton	m_p	$= 1.7 \times 10^{-27} \ kg$
elementary charge	e	$= 1.6 \times 10^{-19} \ C$
Coulomb's constant	k	$= 9.0 \times 10^9 \ N \cdot m^2/C^2$
permittivity constant	ε_0	$= 8.9 \times 10^{-12} \ C^2/N \cdot m^2$
permeability constant	μ_0	$= 4\pi \times 10^{-7} \ T \cdot m/A$
speed of sound in air ($20°C$)	v_s	$= 340 \ m/s$
speed of light in vacuum	c	$= 3.0 \times 10^8 \ m/s$
Planck's constant	h	$= 6.6 \times 10^{-34} \ J \cdot s = 4.14 \times 10^{-15} \ eV \cdot s$
Boltzmann constant	k_B	$= 1.38 \times 10^{-23} \ J/K$
Universal Gas Constant	R	$= 8.21 \times 10^{-2} \dfrac{L \cdot atm}{mol \cdot K} = 8.31 \dfrac{J}{mol \cdot K}$
Avogadro's Number	N_A	$= 6.02 \times 10^{23} \ mol^{-1}$
Atmospheric Pressure	P_{atm}	$= 1.013 \times 10^5 \ Pa$

Water Properties:

Latent Heat of Vaporization	L_v	$= 540 \ kcal/kg = 2.3 \times 10^6 \ J/kg$
Latent Heat of Fusion	L_f	$= 80 \ kcal/kg = 3.3 \times 10^5 \ J/kg$
Density	ρ_w	$= 1.0 \times 10^3 \ kg/m^3$
Specific heat	c_w	$= 1.0 \ kcal/kg \cdot K = 4.2 \times 10^3 \ J/kg \cdot K$
Specific heat (ice)	c_i	$= 0.50 \ kcal/kg \cdot K = 2.1 \times 10^3 \ J/kg \cdot K$
Specific heat (vapor)	c_v	$= 0.48 \ kcal/kg \cdot K = 2.0 \times 10^3 \ J/kg \cdot K$