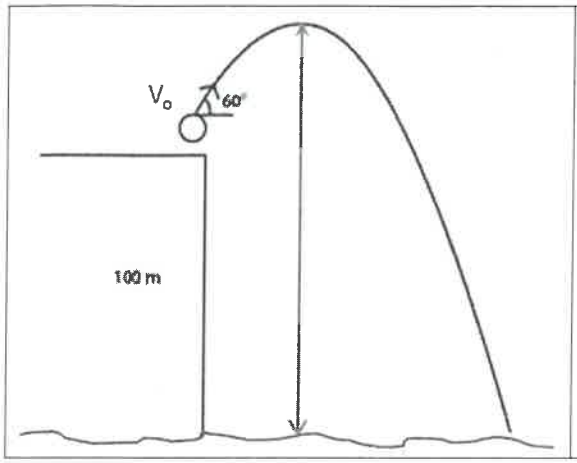
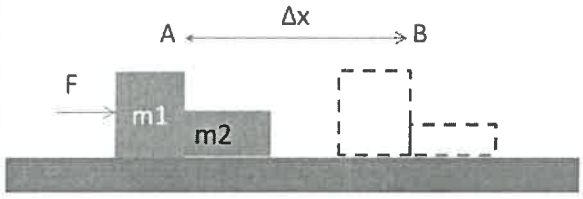
**Physics 1005 (F19) Exam1b, Name**_____, **ID#**_____, **Score**_____

1. **(2D kinematics; 30%)** As shown below, an object is launched from a 100-m building-top with a speed of **25**m/s in an angle of 60 degree from horizontal and lands on the ground. Use g = 10 m/s$^2$ for this problem.



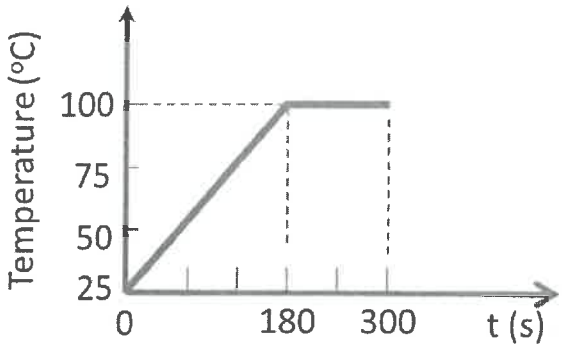

a. What is the vertical initial-launching speed? **Ans.** 22 m/s
b. How long does it take for the object to reach to the maximum height? **Ans.** 2.2 s
c. What is the maximum height the object can reach **above the ground**? **Ans.** 123 m
d. How long does it take for the object to reach the ground **after reaching the maximum height**? **Ans.** 5 s
e. How far horizontally the object can reach away from the building when it lands? **Ans.** ~~180 m~~ 90 m
f. What is **the vertical speed** just before it hits the ground? **Ans.** 50 m/s

2. **(Dynamics/energetics, system/sub-system, action/reaction forces; 40%)** Two mass-blocks **initially (t = 0) at rest** in the position A as shown below are being pushed by a force **F** on a frictionless table top to the position B.




Given: F = 100 N, $m_1$ = 16 kg, $m_2$ = 4 kg, and Δx = **20** m.
Find:
a. Net force on the two-block system, **Ans.** 100 N
b. The value acceleration of two-block system, **Ans.** 5 m/s$^2$
c. The value of action force on block-$m_2$, **Ans.** 20 N
d. The value of reaction force on block-$m_1$, **Ans.** 20 N
e. Net force on block-$m_1$, **Ans.** 80 N
f. Net force on the block-m2, **Ans.** 20 N
g. Work done by the force F when the mass-blocks is being pushed from the position A to B, **Ans.** 2,000 J
h. Kinetic energy of the mass-blocks at the position B, **Ans.** 2,000 J

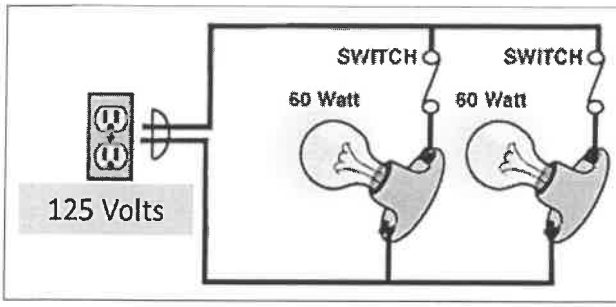
3. **(Heat capacity, latent heat of evaporation; 10%)** In our lab experiment, 0.50-kg water at room temperature, 25 °C, was being heated by a heater. The temperature vs. time was measured as shown below (ideal case).




Given the specific heat for water, $C_w$ = 4186 J/ (kg oC),
Find:

a. the value of temperature increase at t = 180 s, **Ans.** 75°C
b. the value of energy transferred to water at t = 180 s, **Ans.** 150,915 J
c. energy transfer rate during the heating process from 0 to 180 s, $P_h$, **Ans.** 812 W
d. At t = 300 s, the heater was turned off and the amount of water was re-weighted to be 0.46 kg. What is the latent heat of water evaporation,
**Ans.** $2.6 \times 10^6$ J/kg

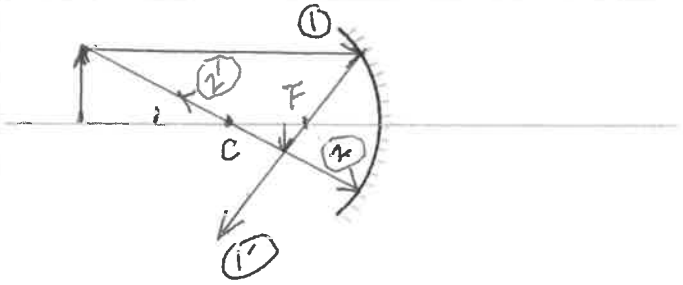
4. **(Ohm's law, and electric power, 10%)** Two Incandescent light bulbs, specified as 60 W @ 120 V, are connected to the local power supply (V = 125 V) as shown below.




Find:

a. the value of resistance of the left light bulb, **Ans.** 240 Ω
b. the current passing the left light bulb, **Ans.** 0.52 A
c. the voltage on the right light bulb, **Ans.** 125 V
d. the actual electric power of right light bulb, **Ans.** 65 W

5. **(Geometric optics; 10%)**




Given: R = 20 mm, $h_0$ = 10 mm (height), and p = 40 mm.

Find:

a) Focal length, f. **Ans.** 10 cm
b) q, **Ans.** 13.3 cm
c) $h_i$, **Ans.** −3.3 cm
d) Ray-diagram confirmation [you must show 1-1' and 2-2'rays] (6%)
e) Is the image real or virtual? **Ans.** real

| *Topics* | *Reference Equations* | | |
|---|---|---|---|
| Kinematics ($a \neq 0$) | $v = v_0 + at$ | $x = x_0 + v_0 t + (1/2)at^2$ | $v^2 = v_0^2 + 2a(x - x_0)$ |
| Newton's 2nd law | $F_{net} = m\,a$ | | |
| Specific heat/latent heat | $\Delta Q = c\,m\,\Delta T$ | $L = \Delta Q/\Delta m$ | $\Delta Q_{eva} = P_h\,\Delta t_{eva}$ |
| Ohm's law | $I = V/R$ | $P = IV$ | |
| Geometric optics | $1/p + 1/q = 1/f$ ; $f = \pm R/2$ | ~~$M = h_o/h_i$~~ $M = h_i/h_o$ | $M = -q/p$ |
| | | | |
| Math | $\sin(60°) = \frac{\sqrt{3}}{2}$ | $\cos(60°) = \frac{1}{2}$ | |