Exam 3 Solutions

Multiple Choice Key

1. d
2. e
3. b
4. a
5. d
6. b
7. c
8. c
9. e
10. c

Worked Problems

1. Start with the general Doppler shift formula:

$$f' = (\frac{1 \pm u_o/v}{1 \mp u_s/v})f$$

   - In this case, $u_o = 5.0\ m/s$, $u_s = 25\ m/s$, and $f = 210\ Hz$.
   - Hobo is moving away from train, so top sign should be minus, train is moving toward hobo, so bottom sign is also minus.
   - Sticking in values, gives $f' = 223\ Hz$.

2. This is an energy conservation problem:

$$K_i + U_i = K_f + U_f$$

   - In this case, $U = U = -G\frac{m_1 m_2}{r}$, where $r_i = r_e + 300\ km$ and $r_f = r_e$ (Note that you are *not* free to set either potential energy to zero!)

- Since the object starts from rest, $K_i = 0$, so

$$K_f = G\frac{mm_e}{r_e} - G\frac{mm_e}{(r_e + h)}.$$

- For part b, solve $K = \frac{1}{2}mv^2$ for v.