Practice Final Exam
Answer Section

TRUE/FALSE

1. ANS: F (parabolic)
2. ANS: F (Force of water on propeller)
3. ANS: F (Both elevator and passenger fall at the same rate)
4. ANS: F (Straight vertical line)
5. ANS: T (800 Hz)
6. ANS: F (all instrument vibrate including a synthesizer- they use an external speaker to produce sound)
7. ANS: F (dispersion)
8. ANS: F (converging lens)
9. ANS: F (reflective telescopes are superior to refractive telescopes (Galilean) in every way except refractive telescopes are smaller)

MULTIPLE CHOICE

10. ANS: D
11. ANS: B
12. ANS: D
13. ANS: A
14. ANS: E
15. ANS: D
16. ANS: E
17. ANS: D
18. ANS: A
19. ANS: A
20. ANS: A
21. ANS: E
22. ANS: B
23. ANS: D
24. ANS: C
25. ANS: C
26. ANS: E
27. ANS: E
28. ANS: D
29. ANS: C
30. ANS: E
31. ANS: A
32. ANS: D
33. ANS: E

COMPLETION

34. ANS: velocity, speeds
35. ANS: net force, object's mass
36. ANS: Galileo

MATCHING

37. ANS: B

38. ANS: B

SHORT ANSWER

39. ANS:
Static friction is the force that prevents an object from beginning to slide. Starting friction is the maximum static friction which acts just as the object begins to slide.

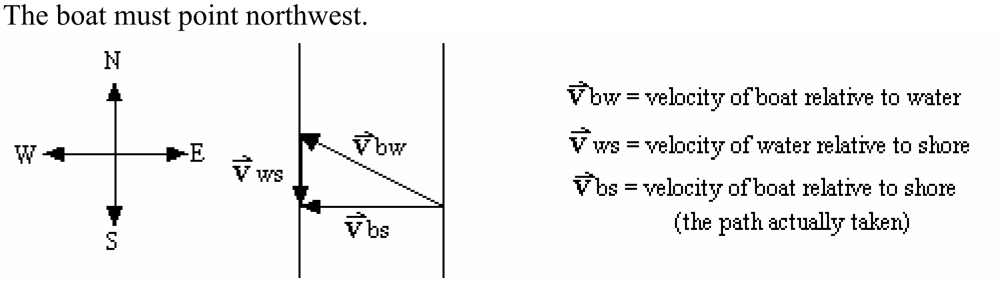
40. ANS:

(a) no effect (wavelength is independent of amplitude)
(b) increase in wavelength (according to the wave equation, $v \propto \lambda$)
(c) decrease in wavelength $\left(\text{according to the wave equation, } \lambda \propto \dfrac{1}{f}\right)$

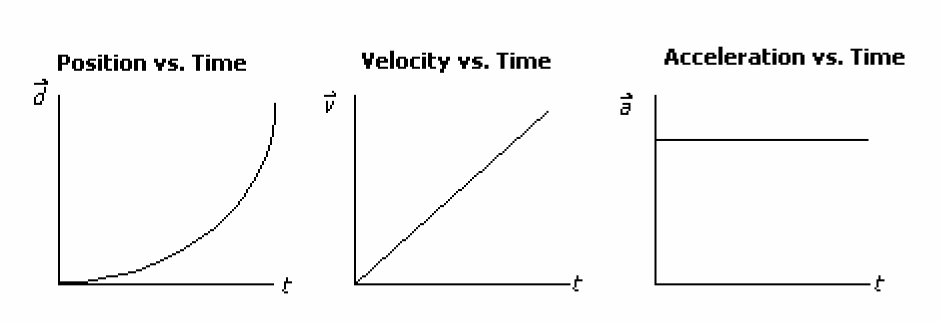
41. ANS:
Only a converging lens can produce a image that is larger than the object.

42. ANS:
Connecting in parallel allows each appliance to be turned on or off without interrupting the flow of current to the others. In a series circuit, if one appliance is turned off, the current would have no path to the others.

43. ANS:
The boat must point northwest.



44. ANS:



PROBLEM

45. ANS:

(a) $\Delta d = v_i \Delta t + \frac{a(\Delta t)^2}{2}$

$= 20\ \text{m/s}(4.0\ \text{s}) + \frac{2.0\ \text{m/s}^2(4.0\ \text{s})^2}{2}$

$= 96\ \text{m}$

The car travels 96 m.

(b) $v_f = v_i + a\Delta t$

$= 20\ \text{m/s} + 2.0\ \text{m/s}^2(4.0\ \text{s})$

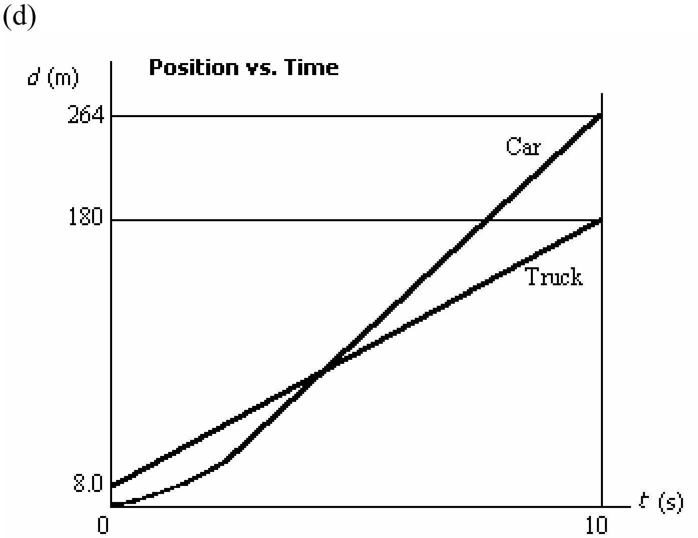
$= 28\ \text{m/s}$

The car's speed is 28 m/s.

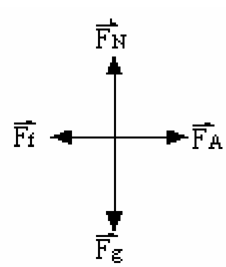
(c) car: $\Delta d = v\Delta t$ = 28 m/s(6.0 s) = 168 m
total: Δd = 96 m + 168 m = 264 m
truck: $\Delta d = v\Delta t$ = 18 m/s(10.0 s) = 180 m

Car's lead after 10.0 s: Δd = 264 m – 180 m – 8.0 m = 76 m

(d)



46. ANS:
Let [fwd] be "positive" and [bkwd] be "negative".



$\vec{F}_{net} = \vec{F}_A + \vec{F}_f$

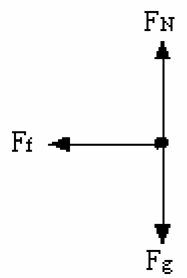
$= 6.8\ \text{N} + (-2.4\ \text{N})$

$= 4.4\ \text{N}$

$$\vec{a} = \frac{\vec{F}_{\text{net}}}{m}$$
$$= \frac{4.4\text{ N}}{1.1\text{ kg}}$$
$$= 4.0\text{ m/s}^2$$

The acceleration is 4.0 m/s² [fwd].

47. ANS:



$$F_{\text{f}} = \mu F_{\text{N}}$$
$$= \mu F_{\text{g}}$$
$$= \mu mg$$
$$= 0.25\left(0.20\text{ kg}\right)\left(9.8\text{ N/kg}\right)$$
$$= 0.49\text{ N (this is acting opposite the motion)}$$

$$\vec{F}_{\text{net}} = \vec{F}_{\text{f}}$$
$$= -0.49\text{ N}$$

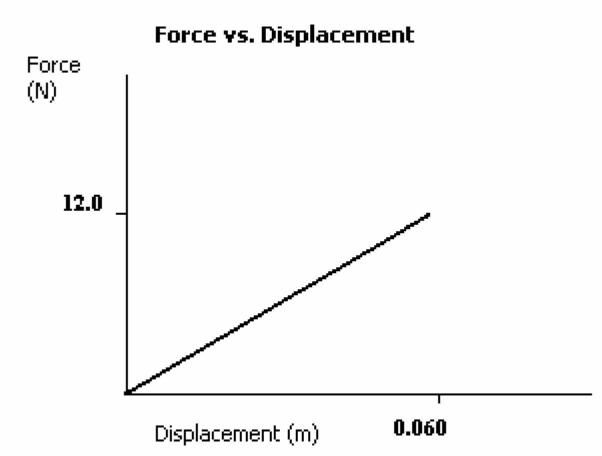
$$\vec{a} = \frac{\vec{F}_{\text{net}}}{m}$$
$$= \frac{-0.49\text{ N}}{0.20\text{ kg}}$$
$$= -2.45\text{ m/s}^2$$

$$\Delta t = \frac{v_{\text{f}} - v_{\text{i}}}{a}$$
$$= \frac{0.0\text{ m/s} - 1.2\text{ m/s}}{-2.45\text{ m/s}^2}$$
$$= 0.49\text{ s}$$

The puck will slide for 0.49 s before stopping.

48. ANS:

(a)



Notice that the units have been changed from cm to m so that the amount of work done on the shovel can be calculated since N·m = J, *not* N·cm.

(b) Work (area) $W = \frac{1}{2} b \times h$

$$= \frac{1}{2}(0.060\text{ m})(12.0\text{ N})$$

$$= 0.36\text{ J}$$

The work done by the man on the shovel over the 6.0 cm is 0.36 J.

49. ANS:
m = 140 kg
F_{net} = 40.0 N
d = 200 cm = 2.00 m
a = 0.25 m/s^2
t = 5.0 s

$$F_{net} = ma$$

$$= (140\text{ kg})\left(0.25\text{ m/s}^2\right)$$

$$= 3.5 \times 10^1\text{ N}$$

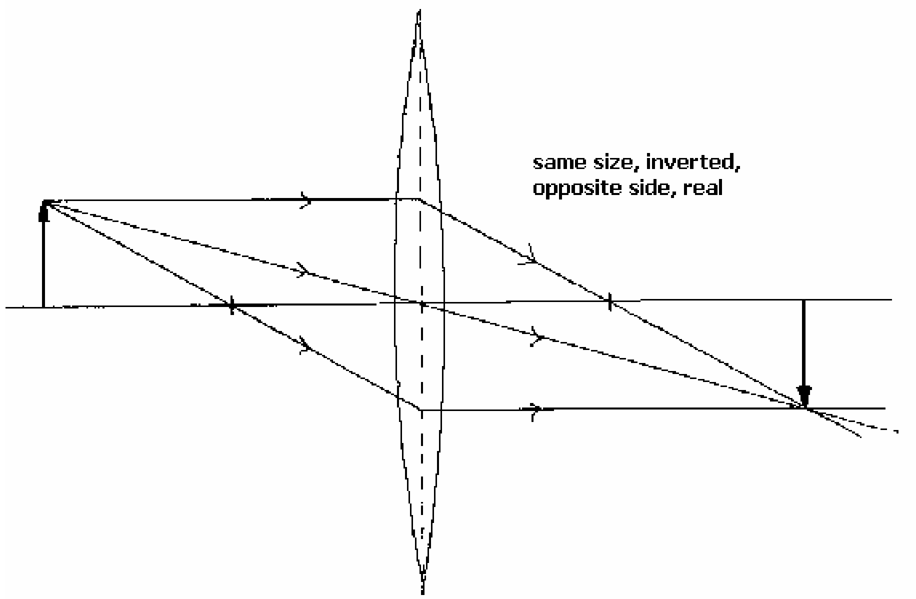
$$\Delta E_k = Fd$$

$$= (3.5 \times 10^1\text{ N})(2.00\text{ m})$$

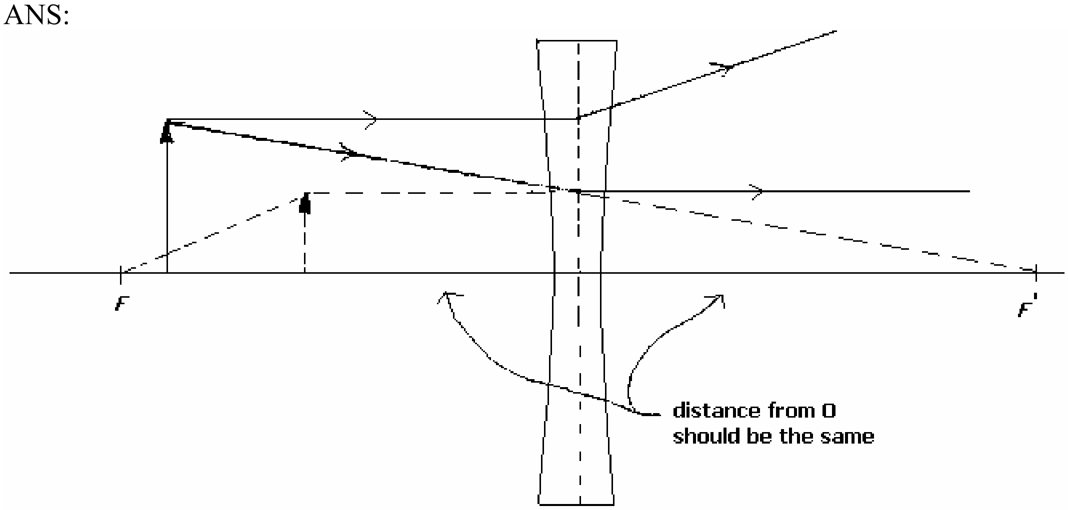
$$= 7.0 \times 10^1\text{ J}$$

The increase in kinetic energy during the 5.0 s is 7.0 × 10^1 J.

50. ANS:



51. ANS:



52. ANS:

$I = 10.0$ A
$\Delta t = 1.00$ s
$e = 1.60 \times 10^{-19}$ C
$N = ?$

$$Q = Ne \qquad I = \frac{Q}{\Delta t}$$

$$N = \frac{Q}{e} \qquad Q = I\Delta t$$

$$N = \frac{I\Delta t}{e}$$

$$= \frac{(10.0\ \text{A})(1.00\ \text{s})}{1.60 \times 10^{-19}\ \text{C}}$$

$$= 6.25 \times 10^{19}$$

6.25×10^{19} electrons pass the point in 1 s.

53. ANS:
$V_p = 220$ V
$V_s = 120$ V
$P_s = 1750$ W
$\frac{N_p}{N_s} = ?$
$I_s = ?$
$I = ?$

(a) $\frac{N_p}{N_s} = \frac{V_p}{V_s}$

$= \frac{220\text{ V}}{120\text{ V}}$

$= 1.83$

The ratio must be 1.8 : 1 ($N_p : N_s$).

(b) $P = VI$

$I_s = \frac{P_s}{V_s}$

$P_s = P_n$

$I_s = \frac{P_n}{V_s}$

$I_s = \frac{1750\text{ W}}{120\text{ V}}$

$= 14.6$ A

The hair dryer will use 14.6 A of current if connected to the transformer.

(c) $P = V^2 R$

$R = \frac{V^2}{P}$

$= \frac{(120\text{ V})^2}{1750\text{ W}}$

$= 8.2\ \Omega$

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

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

$$= \frac{220\text{ V}}{8.2\ \Omega}$$

$$= 26.8\text{ A}$$

The hair dryer would initially operate at 27 A, but would quickly overheat and stop.

54. ANS:
mass of bag (M) = 2.0 kg
mass of bullet (m) = 10 g = 0.010 kg
speed of bag before collision (V) = 0 m/s
speed of bag after collision (V') = ?
speed of bullet before collision (v) = 200 m/s
speed of bullet after collision (v')
height of bag after collision (h) = 10.0 cm = 0.100 m

$$\Delta E_g = -\Delta E_k$$

$$E_{g2} - E_{g1} = -(E_{k1} - E_{k2})$$

$$Mgh - 0\text{ J} = -\left(0\text{ J} - \frac{1}{2}MV^2\right)$$

$$Mgh = \frac{1}{2}MV^2$$

$$V^2 = 2gh$$

$$= 2\left(9.8\text{ m/s}^2\right)(0.100\text{ m})$$

$$V = 1.4\text{ m/s}$$

The speed of the bag after the collision is 1.4 m/s.

55) $f_1 = 510\ Hz$
$f_2 = 520\ Hz$
$V_s = 340\ m/s$

$\therefore f_2 > f_1$
$\therefore$ moving towards

$$f_2 = f_1\left(\frac{V_s}{V_s - V_o}\right)$$

$$\frac{f_2}{f_1} = \frac{V_s}{V_s - V_o}$$

$$\frac{f_1}{f_2} = \frac{V_s - V_o}{V_s}$$

$$\frac{f_1}{f_2} V_s = V_s - V_o$$

$$V_o = V_s - \frac{f_1}{f_2}(V_s)$$

$$V_o = V_s\left(1 - \frac{f_1}{f_2}\right)$$

$$V_o = 340\left(1 - \frac{510}{520}\right)$$

$$V_o = 6.54\ m/s$$

56) $f_1 = 400\ Hz$
$f_2 = ?$
# beats = 20
time = 5.0 s

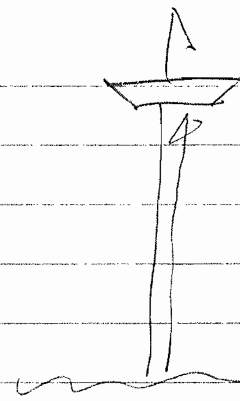
$$f_{beat} = \frac{20}{5.0} = 4.0\ Hz$$

$f_{beat} = f_2 - f_1$
$4.0 = f_2 - 400$
$404\ Hz = f_2$

or $f_{beat} = f_1 - f_2$
$4.0 = 400 - f_2$
$f_2 = 400 - 4$
$f_2 = 396\ Hz$

$\therefore f_2 = 404\ Hz$ or $396\ Hz$

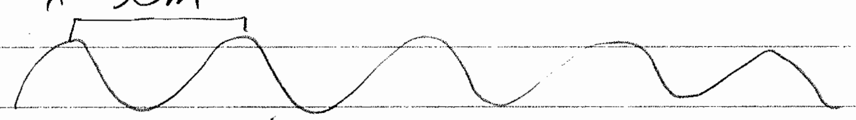
57) $t_{tot} = 0.4s$
$v_s = 1500 m/s$



$d_{round\ trip} = v_s \cdot t$
$= (1500)(0.4)$
$= 600m$

So $d_{bottom} = \frac{1}{2} d_{round\ trip}$
$= 300m$

58) $\lambda = 30m$

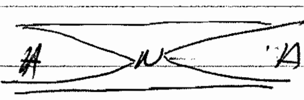


$v_s = 8.0 m/s$

$v = f\lambda$
$f = \frac{v}{\lambda}$
$f = \frac{8.0}{30}$
$f = \frac{4}{15}\ Hz$

$T = \frac{1}{f}$
$T = \frac{1}{4/15}$
$T = \frac{15}{4}$
$T = 3.75s$

59) $f = 262\ Hz$
$T = 20°C$



$L = \frac{1}{2}\lambda$

$v_s = 332 + 0.6T$
$v_s = 332 + 0.6(20)$
$v_s = 344\ m/s$

$v = f\lambda$ & $L = \frac{1}{2}\lambda$
$\lambda = \frac{v}{f}$ | $2L = \lambda$

$2L = \frac{v}{f}$

$L = \frac{v}{2f}$

$L = \frac{344}{2(262)}$

$L = 0.6565\ m$

60. $V_{car} = 0.16$ Mach
$T = 20°$

$$mach = V_s = 332 + 0.6T$$
$$= 332 + 0.6(20)$$
$$= 326 \text{ m/s}$$

$$V_{car} = 0.16 \text{ mach}$$
$$= 0.16(326)$$
$$= 52.16 \text{ m/s} \xrightarrow{3.6\times} 187.8 \text{ km/h}$$

61. Since θ_c for diamond is smaller than crown glass, you are likely to more internal reflections. More internal reflections the more sparkly :)

"Physics is a nerd's best friend"

62. Given
$d_o = 12$ cm
$h_o = 0.7$ cm
$f = 20$ cm

RTF
h_i, d_i, type

Solution

$$\frac{1}{d_i} + \frac{1}{d_o} = \frac{1}{f}$$

$$\frac{1}{d_i} + \frac{1}{12} = \frac{1}{20}$$

$$\frac{1}{d_i} = \frac{1}{20} - \frac{1}{12}$$

$$\frac{1}{d_i} = \frac{12-20}{240}$$

$$\frac{1}{d_i} = \frac{-8}{240}$$

$$d_i = \frac{-240}{8}$$

$$\boxed{d_i = -30 \text{ cm}}$$

type = Virtual (negative d_i)

Find h_i

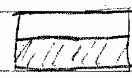
$$\frac{h_i}{h_o} = \frac{-d_i}{d_o}$$

$$h_i = \frac{-d_i h_o}{d_o}$$

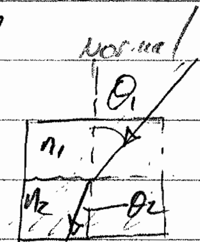
$$h_i = \frac{-(-30)(0.7)}{12}$$

$$\boxed{h_i = 1.75 \text{ cm}}$$

63. 1) place the liquid in a container



2) Aim a laser at some known angle of incidence



3) use Snell's law to find n_2

$$n_2 = \frac{n_1 \sin\theta_1}{\sin\theta_2}$$

$n_1 = 1$ (air)
$\theta_1 =$ you measure
$\theta_2 =$ you measure

64. $n_1 = 1.33$
$n_2 = 1.31$

$$\theta_c = \sin^{-1}\left(\frac{n_2}{n_1}\right)$$
$$= \sin^{-1}\left(\frac{1.31}{1.33}\right)$$
$$= 80^\circ$$

65. Given
Earth
$F_g = 1.2 \times 10^3 N$

$d = -2.8 m$
$E_g = 1.1 \times 10^3 J$

a) First Find the mass of the astronaut

$$F_{g_{Earth}} = m g_{earth}$$
$$m = \frac{F_g}{g}$$
$$m = \frac{1.2 \times 10^3}{9.8}$$
$$m = 122.4 kg$$

Find g_x

$$E_{g_x} = m g_x h$$
$$g = \frac{E_{g_x}}{mh}$$
$$g = \frac{1.1 \times 10^3}{(122.4)(2.8)}$$
$$g = 3.21 \; m/s^2 \text{ or } N/kg$$

c)

$$E_{k_2} + \cancel{E_{g_2}}^{0} = \cancel{E_{k_1}}^{0} + E_{g_1}$$
$$\frac{1}{2}\cancel{m}v_2^2 = \cancel{m}gh_1$$
$$v_2 = \sqrt{2gh_1}$$
$$= \sqrt{2(3.21)(2.8)}$$
$$v_2 = 4.24 \; m/s$$