Physics 11 Final Exam Review Questions

Chapter 1/2

1. A diving board makes 36.0 cycles in 22.00 seconds. Find the frequency and the period.

$f = \frac{n}{t} = \frac{36}{22} = 1.64\ Hz$ $T = \frac{1}{f} = \frac{1}{1.64} = 0.611\ s$

2. A rocket accelerates from 24.0 to 36 m/s. If it travels 125 m, how much time does it take?

$v_i = 24$
$v_f = 36$
$d = 125$
$a = X$
$t = ?$

$d = \frac{1}{2}(v_i + v_2)t$
$125 = \frac{1}{2}(24+36)t$
$t = 4.17\ s$

3. What is the acceleration of a car that accelerates from 12.0 m/s to 46.0 m/s over a distance of 156 m?

$v_i = 12$
$v_f = 46$
$d = 156$
$a = ?$
$t = X$

$v_f^2 - v_i^2 = 2ad$
$46^2 - 12^2 = 2a(156)$
$a = 6.32\ m/s^2$

4. Find the displacement and the final velocity of a ball that is thrown upwards with an initial velocity of 48.0 m/s and is in the air for 6.0 seconds? ✱ $a = g = -9.8\ m/s^2$

$v_i = 48$
$v_f = X$
$d = ?$
$a = -9.8$
$t = 6$

$d = v_i t + \frac{1}{2}at^2$
$d = 48(6) + \frac{1}{2}(-9.8)(6^2)$
$d = 112\ m$

$v_f = v_i + at$
$v_f = 48 + (-9.8)(6)$
$v_f = -11\ m/s$

Chapter 3

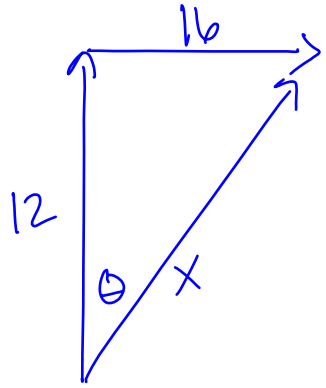
5. What is the change in velocity and the acceleration of an object that goes from 40.0 m/s [E] to 180 m/s [W] in 27.5 s?

$\Delta V = V_f - V_i$ ★ add the opposite

$= 180\,[W] - 40\,[E] = 180\,[W] + 40\,[W] = 220\ m/s\,[W]$

$a = \frac{\Delta V}{t} = \frac{220\,[W]}{27.5} = 8.00\ m/s^2\,[W]$

6. A boat that is able to travel 12.0 m/s through the water attempts to travel straight across a 170m wide river that is flowing at 16.0 m/s without anticipating the current. Determine the resulting velocity of the boat, the time to cross the river, and the distance downstream it lands.



$X^2 = 12^2 + 16^2$

$X = 20\ m/s$

$\tan\theta = \frac{16}{12}$

$\theta = 53.1°$ downstream

$d = vt$ ★ d & v must be parallel

$170 = 12t$

$t = 14.2\ s$

$d = vt$

$d = 16(14.2)$

$d = 227\ m$

Chapter 4

7. Find the final velocity and the time required for an egg that starts from rest to fall 180m.

$v_i = 0$

$v_f = ?$

$d = -180$

$a = -9.8$

$t = ?$

$v_f^2 - v_i^2 = 2ad$

$v_f^2 - 0^2 = 2(-9.8)(-180)$

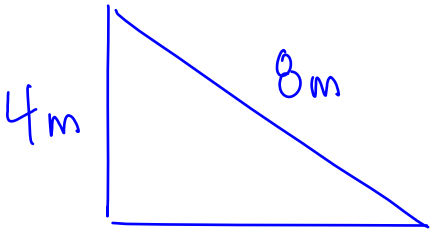
$v_f = -59.4\ m/s$

$d = v_i t + \frac{1}{2}at^2$

$-180 = \frac{1}{2}(-9.8)t^2$

$t = 6.06\ s$

8. Find the acceleration and the final velocity for an object that starts with an initial velocity of 12 m/s to slide down an 8.00 m long and 4.00 m high ramp.



$a = g\left(\frac{h}{d}\right)$

$= 9.8\left(\frac{4}{8}\right)$

$= 4.9\ m/s^2$

$v_i = 12$

$v_f = ?$

$d = 8$

$a = 4.9$

$t = x$

$v_f^2 - v_i^2 = 2ad$

$v_f^2 - 12^2 = 2(4.9)(8)$

$v_f = 15\ m/s$

9. How long will it take a 14 m pendulum to make 32 cycles?

$T = 2\pi\sqrt{\frac{L}{g}} = 2\pi\sqrt{\frac{14}{9.8}} = 7.51 s$

$T = \frac{t}{n}$

$7.51 = \frac{t}{32}$

$t = 240 s$

10. A projectile is launched horizontally at 36 m/s from a 19.6 m high cliff. Determine the time of flight and the distance it travels.

	Vert	horiz
$v_i =$	0	36
$v_f =$	X	
$d =$	-19.6	?
$a =$	-9.8	
$t =$		

$d = v_i t + \frac{1}{2} a t^2$

$-19.6 = 0 + \frac{1}{2}(-9.8) t^2$

$t = 2 s$

$d = vt$

$d = 36(2)$

$d = 72 m$

11. A dart is thrown horizontally at a dart board 2.8 m away. The dart drops by 32 cm before it hits the dartboard. What was the initial speed of the dart?

	Vert	horiz
$v_i =$	0	?
$v_f =$	X	
$d =$	$-.32$	2.8
$a =$	-9.8	
$t =$		

$d = v_i t + \frac{1}{2} a t^2$

$-.32 = 0 + \frac{1}{2}(-9.8) t^2$

$t = .256 s$

$d = vt$

$2.8 = v(.256)$

$v = 11 m/s$

Chapter 5

12. What is the distance between a 128 kg object and a 136 kg object if the gravitational force of attraction between them is 6.582×10^{-10} N?

$F_g = \frac{G m_1 m_2}{r^2}$

$6.582 \times 10^{-10} = \frac{6.67 \times 10^{-11}(128)(136)}{r^2}$

$r^2 = 1764$

$r = 42 m$

13. Two students are on a skateboards and push away from each other. A 48 kg student accelerates away at 2.6 m/s^2. Find the acceleration of the other student if their mass is 32 kg. Equal & opposite forces

$F_{net} = ma$

$= 48(2.6)$

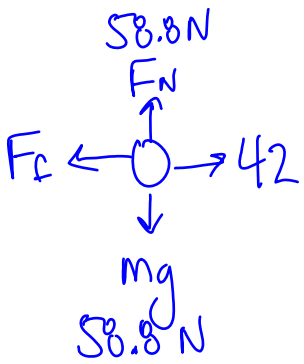
$F_{net} = 124.8\ N$

$F_{net} = ma$

$-124.8 = 32a$

$a = -3.9\ m/s^2$

14. A 42.0 N force is applied to a 6.00 kg block but it only accelerates at 5.50 m/s^2. Determine both the force and the coefficient of friction.



$F_{net} = ma$

$42 - F_f = 6(5.5)$

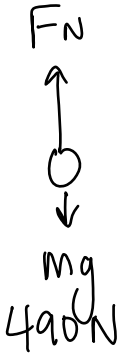
$F_f = 9.0\ N$

$F_f = \mu F_N$

$9 = \mu(58.8)$

$\mu = 0.153$

15. What is the size of the normal force from the floor of an elevator on a rider whose weight is 490 N if the elevator accelerates up at a rate of 0.650 m/s^2?



$F_{net} = ma$

$F_N - 490 = 50(.650)$

$F_N = 523\ N$

$F_g = mg$

$490 = m(9.8)$

$m = 50\ kg$

16. What is the force applied to a 17.0 kg object that changes its velocity from 18.0 m/s to −38.5 m/s in a time of 14.0 s?

$Ft = m\Delta V$

$F(14) = 17(-38.5 - 18)$

$F = -68.6\ N$

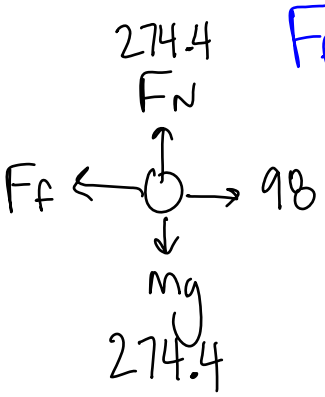
17. An 800 kg Volkswagen bug traveling at 6.4 m/s [E] bumps into a 5400 kg dump truck that is traveling at 2.8 m/s [W]. If the speed of the Volkswagen after the collision is 3.5 m/s [W], what is the final velocity of the dump truck?

West is −ve

$800(6.4) + 5400(-2.8) = 8000(-3.5) + 5400\,v_f$

$v_f = -1.3$ m/s or 1.3 m/s [W]

18. What is the final velocity of a 28.0 kg object that has an initial velocity of 12.5 m/s and an applied force of 98.0 N as it slides for 6.80 s across a rough floor where $\mu = 0.480$?



$F_f = \mu F_N$

$= .480(274.4)$

$= 131.712$

$F_{net} = ma$

$98 - 131.712 = 28a$

$a = -1.204$

$v_f = v_i + at$

$v_f = 12.5 + (-1.2)(6.8)$

$v_f = 4.31$ m/s

19. What is the gravitational field strength on a planet where a 7.7 m long pendulum cycles 48 time in 214 s?

$g = \frac{4\pi^2 L}{T^2} = \frac{4\pi^2(7.7)}{4.46^2} = 15\ m/s^2$

$T = \frac{t}{n} = \frac{214}{48} = 4.46s$

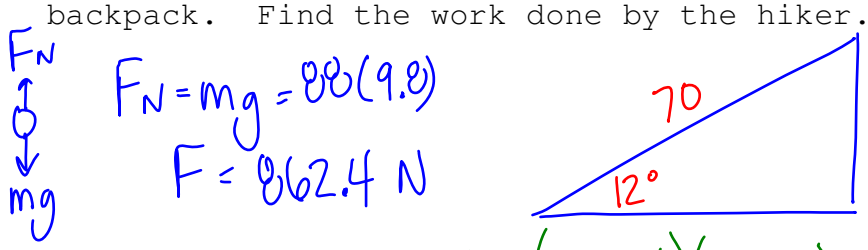
Chapter 6

20. A 60 kg climber, carrying 4.5 kg of gear, ascends a vertical cliff to a height of 8.6 m. If the climb took 18 minutes, what power did the climber produce?

$P = \frac{W}{t} = \frac{mgh}{t} = \frac{64.5(9.8)(8.6)}{(18 \times 60)} = 5.03\ W$

↑ t in (s)

21. A 73 kg hiker walks 70 m up a 12° incline while wearing a 15 kg backpack. Find the work done by the hiker.



$F_N = mg = 88(9.8)$

$F = 862.4$ N

$(\sin 12)(70) = d_{//}$

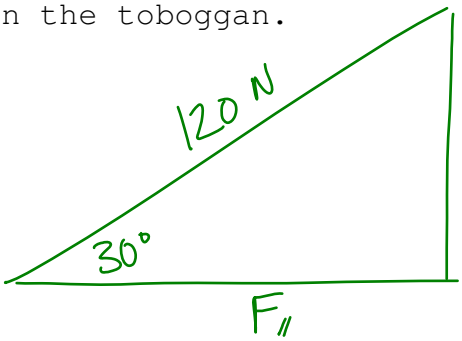
$d_{//} = 14.55$ m

$W = Fd = (862.4)(14.55)$

$= 12550$ J

22. A 7.2 kg toboggan is pulled 8.4 m horizontally. If the rope is held at an angle of 30° and is pulled with a force of 120 N, find the work done on the toboggan.

d is horiz



$120(\cos 30) = F_{//}$

$F_{//} = 103.9$ N

$W = Fd = (103.9)(8.4) = 873$ J

23. A 0.054 kg ball is thrown straight up at a velocity of 14 m/s from the top of a 28 m tall building. Find the velocity of the ball when it is 6.0 m above the ground.

$mgh + \frac{1}{2}mv^2 + F_a d = mgh + \frac{1}{2}mv^2 + F_f d$

$(.054)(9.8)(28) + \frac{1}{2}(.054)(14)^2 = (.054)(9.8)(6) + \frac{1}{2}(.054)v^2$

$20.1096 = 3.1752 + .027v^2$

$v = 25$ m/s

24. A 54 kg girl on a 12 kg bike is moving at 19 km/h (5.28 m/s) down a 10 m tall hill. She hits her brakes at the bottom of the hill and skids to a stop in 20.5 m. Find the force of friction.

$mgh + \frac{1}{2}mv^2 + F_a d = mgh + \frac{1}{2}mv^2 + F_f d$

$(66)(9.8)(10) + \frac{1}{2}(66)(5.28)^2 = F_f(20.5)$

$F_f = 360$ N

25. A 7.3 kg cannon ball is shot from a 3.0 m long cannon and leaves with a velocity of 85 km/h. Find the force that propelled the cannon ball from the cannon.

23.61 m/s

$mgh + \frac{1}{2}mv^2 + F_a d = mgh + \frac{1}{2}mv^2 + Fd$

$F_a(3) = \frac{1}{2}(7.3)(23.61)^2$

$F_a = 678\ N$

Chapter 7

26. Michelson and Morley revolutionized physics in 1887 when they discovered that ether does not exist. What two assumptions can we draw based on this finding?

Light has no prefered reference frame

The speed of light is constant in every ref. frame

27. A school bus and a motorcycle move past each other at a relative velocity of 2.76×10^8 m/s. The person on the motorcycle measures the bus at 3.92 m long.

a) How long is the bus according to students on the bus?

$\beta = .92 \quad \gamma = 2.552$

We want rest length (long)... $L = 3.92(2.552) = 10\ m$

b) How long did it take for the motorcycle to pass according to students on the bus? → use length according to them

$d = vt$

$10 = 2.76 \times 10^8 t \quad t = 3.62 \times 10^{-8}\ s$

c) How long did it take to pass the bus according to the driver of the motorcycle?

$d = vt$

$3.92 = 2.76 \times 10^8 t$

$t = 1.42 \times 10^{-8}\ s$

-or-

$\beta = .92 \quad \gamma = 2.552$

want 1 clock time...

$t = \frac{3.62 \times 10^{-8}}{2.552} = 1.42 \times 10^{-8}\ s$

28. A student running at 2.4×10^8 m/s throws a frisbee at 1.5×10^8 m/s. What is the velocity of the frisbee relative to the ground?

$$V_T = \frac{2.4 \times 10^8 + 1.5 \times 10^8}{1 + \frac{(2.4 \times 10^8)(1.5 \times 10^8)}{(3 \times 10^8)^2}} = \frac{3.9 \times 10^8}{1.4} = 2.79 \times 10^8\ m/s$$

29. How much energy could be produced from an empty pop can (mass = 17 g) if it is entirely converted into energy?

$E = mc^2 = (.017\ kg)(3 \times 10^8)^2 = 1.53 \times 10^{15}\ J$

Chapter 9

30. If I=4.5 A flow through a wire, how much charge ('q') passes in 38 s?

$I = \frac{q}{t} \quad 4.5 = \frac{q}{38} \quad q = 171\ C$ (coulombs)

31. Four identical lights are wired in series to a 12.0 V battery. The total power of all of the lights is 18.0 W

a) Find the power dissipated by each bulb.

$\frac{18}{4} = 4.5\ W$

b) How much current passes through the circuit?

$P = IV \quad 18 = I(12) \quad I = 1.5\ A$

c) Find the total resistance of the circuit.

$R_T = \frac{V_T}{I_T} = \frac{12}{1.5} = 8.0\ \Omega$

d) How much energy does each light use in 24.0 s?

$E = Pt = (4.5)(24) = 108\ J$

32. Find the power from a 2.40 kΩ resistor connected to a 12.0 V battery.

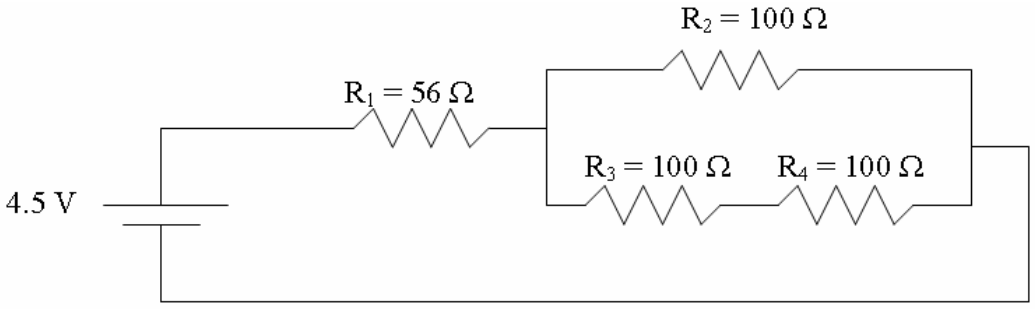
$P = \frac{V^2}{R} = \frac{12^2}{2400} = .060\ W$

33. What if the resistance in the previous question is changed to 1.2 kΩ?

If R decreases, remember that I increases

$P = \frac{V^2}{R} = \frac{12^2}{1200} = 0.12\ W$

34. For the following circuit:



a) Find R_T $R_5 = 200\Omega$ $R_6 = \frac{1}{100} + \frac{1}{200} = 66.7\Omega$ $R_T = 56 + 66.7 = 123\Omega$

b) What is the voltage drop at R_4?

$I_T = \frac{4.5}{123} = .0367\ A$ $R_1 = .0367\ A$ $= 2.06\ V$

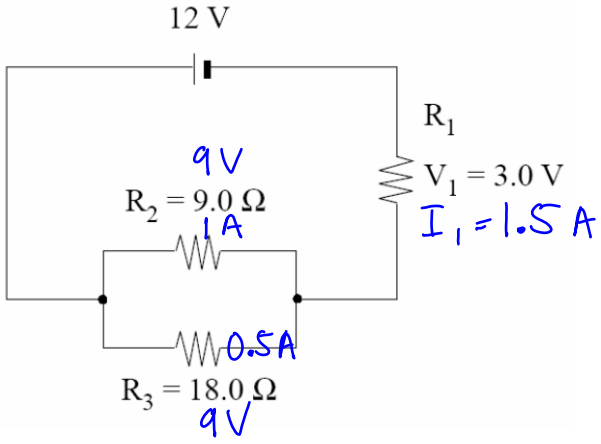
(LOOPS) $R_2 = 4.5 - 2.06 = 2.44V$ $= .0244A$

(JUNCTIONS) $R_3 = .0367 - .0244 = .0123\ A$

$R_4 = .0123\ A$

$R_4 = 1.23\ V$

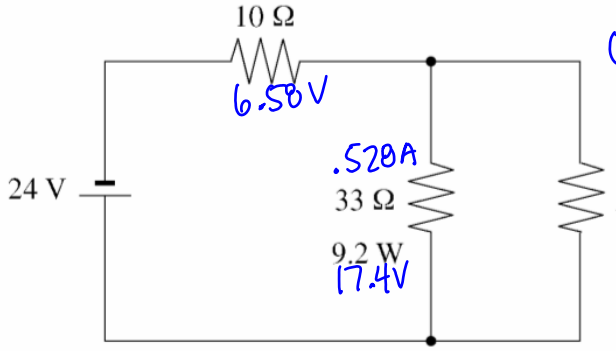
35. Find the current through the battery in the following circuit.



$I_1 = I_T = 1.5\ A$

(LOOPS) $R_2 = R_3 = 12 - 3 = 9.0V$

36. What is the total power dissipated in the three resistors below?



① $P = I^2R$ $I = .528A$

② $P = \frac{V^2}{R}$ $V = 17.4V$

③ (LOOPS) $24 - 17.4 = 6.58V$

④ (OHMS) $I = \frac{V}{R} = \frac{6.58}{10} = .658\ A$

⑤ $P_T = I_T V_T$ $= (.658)(24) = 15.8\ W$

Chapter 10

37. Waves in a lake travel a distance of 26 m in 7.3 s. The distance from a crest to the adjacent trough is 60 cm. How many waves pass one point in the lake every 3.0 min?

$v = \frac{d}{t} = \frac{26}{7.3} = 3.56$ m/s

$\lambda = 2(.60\text{m}) = 1.2$ m

$v = \lambda f$

$3.56 = 1.2 f$

$f = 2.97$ Hz

$f = \frac{n}{t}$

$2.97 = \frac{n}{180}$

$n = 534$ waves

38. If a guitar string has a mass of 1.38 grams and a length of 71 cm, determine the tension necessary for a wave with a frequency of 440 Hz to have a wavelength of 45 cm.

$\mu = \frac{.00138 \text{ kg}}{.71 \text{ m}} = .00194$

$v = \lambda f$

$= .45(440)$

$= 198$ m/s

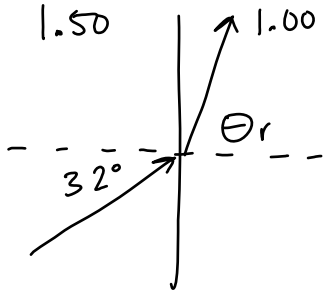
$v = \sqrt{\frac{T}{\mu}}$

$198 = \sqrt{\frac{T}{.00194}}$

$39204 = \frac{T}{.00194}$

$T = 76.2$ N

39. A light ray travels through a boundary from glass (n=1.50) to air (n=1.00). The angle of incidence is 32.0°. Find the angle of refraction.

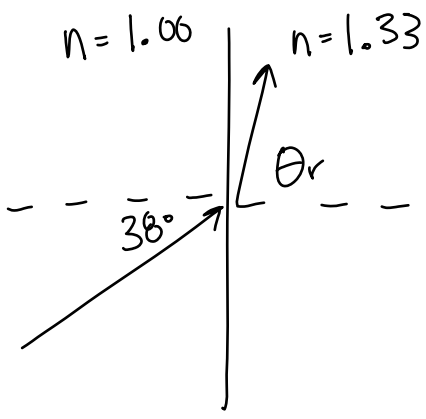


$1.50 \sin 32 = 1.00 \sin \theta_r$

$\theta_r = 52.6°$

40. A light ray travels from air to glass to water (n=1.33). If the light is incident upon the glass at an angle of 38°, at what angle will the light enter the water (compared to the normal)?

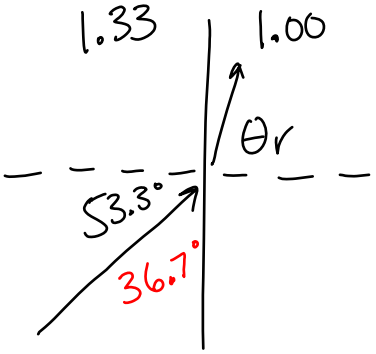
SKIP THE GLASS



$1.00 \sin 38 = 1.33 \sin \theta_r$

$\theta_r = 27.6°$

41. A light ray traveling from water to air strikes the boundary at an angle of 36.7° compared to the boundary line. At what angle does it enter the air?



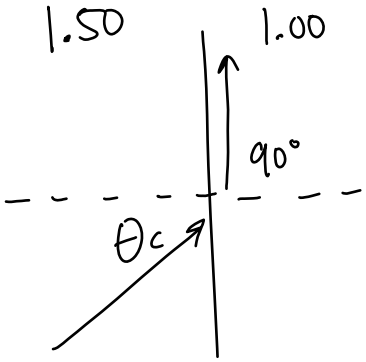
$1.33 \sin 53.3^\circ = 1.00 \sin \theta_r$

θ_r = error

★ Light reflects back at 53.3°

↙ fast side = 90°

42. Find the critical angle for glass (n=1.50) into air.



$1.50 \sin \theta_c = 1.00 \sin 90$

$\theta_c = 41.8^\circ$