Chapter 3 Practice Problem Answers

Lesson 3.01 (Update: 11/27/2019 AO)

3) Here are +, - or 0 but you need to use E_1+W=E_2 to explain and identify the agent:

	a	b	c	d	e	f
Work	+	-	0	+	0	-

4a) W_{net}=60.0 J; (5b) $W_{friction}$=-150 J; (6c) v_2=1.3 m/s

Practice Problems:

15. 240. J
16. 3.651 m/s
17. -66 J
18. 3.3 m/s
19. -200. J

Lesson 3.02 (Update: 12/18/2018)

3. a)W_{Peter}=100. J	c) $W_{gravity}$=0 J	e) KE_2= 40.0 J
b) $W_{friction}$=-60.0 J	d) W_{floor}=0 J	f) v_2=2.83 m/s

4. a)W_{Peter}=-100 J (1.00 X 10^2 J)	c) $W_{friction}$=-60.0 J	e) KE_2= 20.0 J
b) W_{Beth}=+180 J (1.80 X 10^2 J)	d) W_{floor}=0 J	f) v_2=2.00 m/s

5. a)W_{Andre}=+600 J (6.00 X 10^2 J)	b) $W_{friction}$=-150 J	c) KE_2= 450 J

6. a) F_{Cat}, $F_{gravity}$	b) $W_{friction}$	e) iii
• NOTE: You need to have explanations for these answers in your notes.		

Conceptual Practice:
10. a) 10 m b) -2 m c) iv
11. b

Practice Problems:
13. a) 22.5 J b) 0.9 m c) +75 N
14. a) F_{brake} = -10,000 N; b) F_{brake} = -20,000 N; c) no, double!
15. a) W_{Tu} = -2000 J; b) W_{Toan} = 6000 J; c) $W_{friction}$ = -3760 J; d) $F_{friction}$ = -188 N
16. a) KE_1 = 40 J; (b) W_{floor} = 0 J; (c) W_{Fin} = 360 J; (d) KE_2 = 160 J; (e) $W_{friction}$ = -240 J (f) $F_{friction}$ = -80 N
17. v = 8.94 m/s
18 a) 3.4 m/s b) 3.0 m/s c) 2.5 m/s d) 3.0 m/s

Lesson 3.03 (Update: 12/15/2016)

2a) E= 1.6 J b) E= 1.5 J c) W= 1.6 J   2d) Wfriction= -0.1 J

2e) No it doesn't work. Need to modify/clarify the tool.

3) Point	EPE (J)	KE (J)	GPE (J)
1	1.6	0	0
2	0	1.5	0
3	0	0	0

4) d= 3.2 m

5) x= 0.25 m

6a) increase k → increase d

6b) increase x → increase d

6c) increase $F_{friction}$ → decrease d

7

	W_{Ming}(J)	$W_{gravity}$(J)	KE_2 (J)
I	0	36	36
II	-30.6	36	5.4
III	46	-40	6.0

8) KE_2=4 J → choice b

Conceptual Practice:

12. Friction is a non-conservative force because friction removes the energy from the system so it no longer has access to it. Springs and gravitational fields actually store the energy to be returned to the object as kinetic energy.

13. No (be sure to explain in your notes)

Practice Problems

15a) d = 8.0 m; (b) KE_2 = .14 J

16) F_f = -.080 N

17) k = 40. N/m

18) x = 0.500 m

19a) W_{Angela} = 500 J (b) $W_{gravity}$ = 1200 J (c) $W_{friction}$ = -80 J

19d) $F_{friction}$ = 16 N (-16 is fine)

20a) x= 0.367 m (b) x= 0.375 m

21) F_{drag} = 1080 N

22)	$W_{gravity}$ (J)	W_{Louis} (J)	F_{Louis} (N)
From 1 to 2	-1500	1700	1130
From 2 to 3	-200	0	0
Holding at 3	0	0	1000
From 3 to 4	+1700	0	0

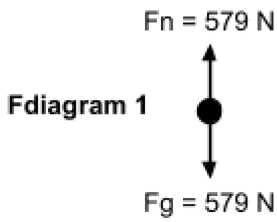
23a) $KE_{1.5}$ = 97.5 J; b) h_3 = 11.3 m
24ai) W_{push} = 24 J; 24aii) W_{wall} = 0 J; 24aiii) $W_{gravity}$ = -12 J; 24aiv) $W_{friction}$ = -9 J
24b) KE_2 = 3 J
25a) W_{Johnna} = 540 J; 25b) $W_{friction}$ = -300 J; 25c) $W_{gravity}$ = -200 J; 25d) W_{ramp} = 0 J
25e) KE_2 = 40 J
26a) EPE_1= 10. J; b) $W_{friction}$ = -3 J; c) $W_{gravity}$ = -6 J; d) KE_2 = 1 J
27a) $W_{gravity}$=+12,500 J, W_{cord}=-11250 J, W_{Drag} = -1250 J; b) F_{drag} = +50 N; c) x = 10 m

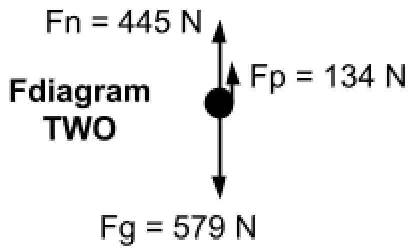
Lesson 3.04 (Update: 11/30/2015)

Conceptual Practice:

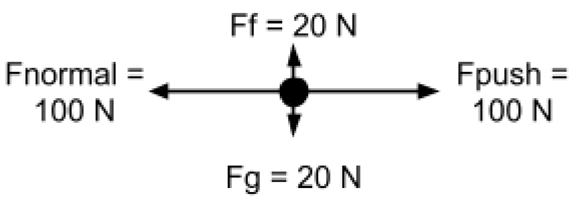
15. a) B b) C c) A d) B

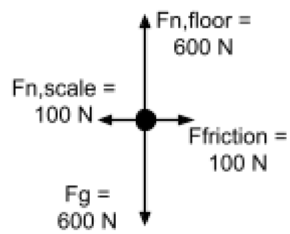
Practice Problems:

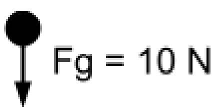
16. a) 

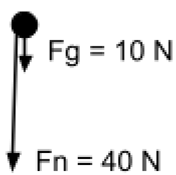
b) 

d) m = 57.9 kg

17. a) 

b) 

18. a) 

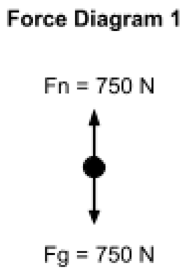
b) 

F_{net} = -50 N

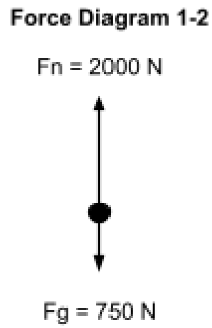
Lesson 3.05 (Update: 11/30/2015)

Practice Problems:

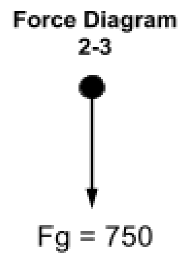
9.a_1)



a_2)



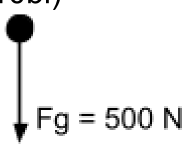
a_3)



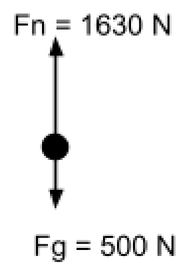
9b) KE_2 = 375 J; c) h_3 = 1.2 m; d) h_3 = 5.4 m *(cool!)*

10 ai) 0 N aii) 1630 N aiii) 500 N

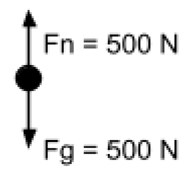
10bi)



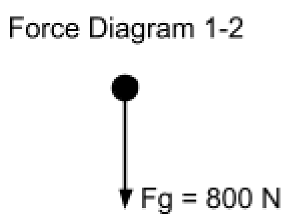
10bii

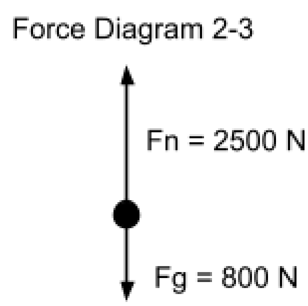


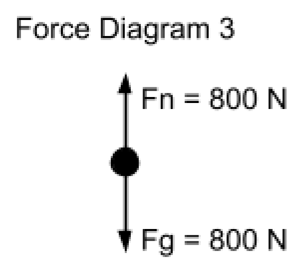
10biii)



11a



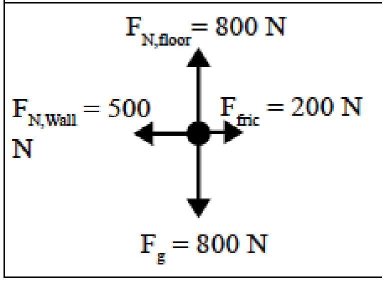
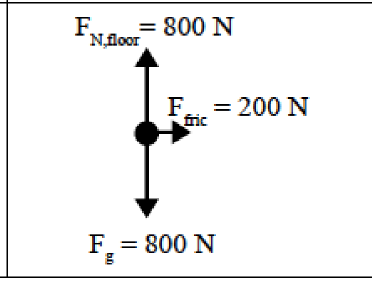
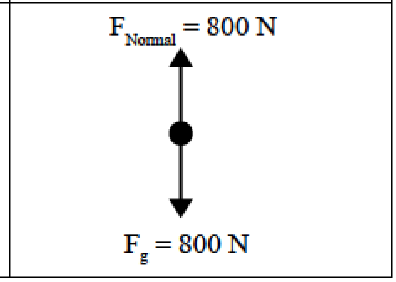




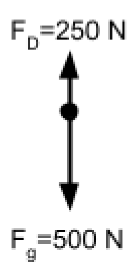
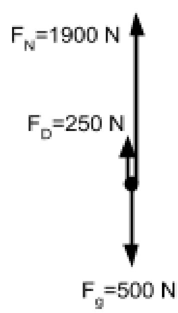
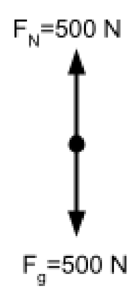
11b) h_3 = .53 m

12. a) 200 N b) from 1-2 there are four forces: gravity (down 800 N), floor normal (up 800 N), scale (left 500 N), friction (right 200 N). from 2-3 there are 3 forces: same as 1-2 but no more scale force.

b)

Between Points 1 and 2	Between Points 2 and 3	At Point 3
 $F_{N,floor}$ = 800 N $F_{N,Wall}$ = 500 N F_{fric} = 200 N F_g = 800 N	 $F_{N,floor}$ = 800 N F_{fric} = 200 N F_g = 800 N	 F_{Normal} = 800 N F_g = 800 N

13. a) F_{normal} =1900 N ($1.90 \times 10^3\ N$) b) See table below

location	1-2	2-3	At 3
force diagram	 F_D=250 N F_g=500 N	 F_N=1900 N F_D=250 N F_g=500 N	 F_N=500 N F_g=500 N

Lesson 3.06 (Update: 1/22/2019, fixed numbering)

Conceptual Practice

11. a) The box continues moving at 2 m/s. b) The box slows down and eventually stops.
    c) The box will move faster and faster. d) The box moves at a constant speed with the same direction.

12. The work energy model is E1 + W = E2. If the net force is zero, then opposing forces do equal and opposite amounts of work. Since the net work is zero, E1 = E2 so the KE energy stays the same, which means the speed stays the same. (Net force includes all forces, including conservative forces associated with PE).

13. a) B; b) B; c) C; d) C

14. NOTE: "1" = slowest

x (m)	0	1.0	2.0	3.0	4.0	5.0
Rank	1	2	3	3	4	4

15. Rank locations by speed: 1 = slowest, fixed 1/23/18

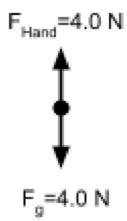
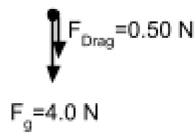
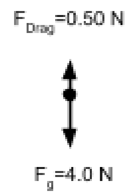
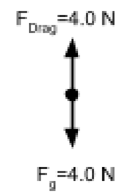
x(m)	0	1	2	3	4	5	6	7	8	9	10
Rank	3	3	3	2	1	3	4	5	6	6	6

Practice Problems

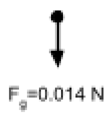
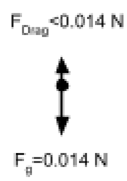
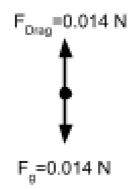
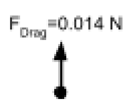
16. a) It is called the "terminal velocity" because at that instant when the drag force is equal to the force of gravity the velocity of the object reaches its maximum since there is no more acceleration and zero net force. The object's velocity can no longer exceed that "terminal velocity".

LESSON 3.06 CONTINUED

16. b)

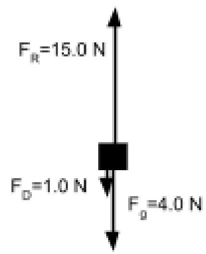
 i)	 ii)	 iii)	 iv)

17.

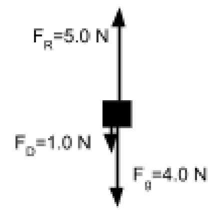
 ai)	 aii)	 aiii)
bi) Fall with increasing speed. 	bii) Continue to fall downward but immediately start slowing to a stop. 	bii) No forces act on the filter so it will have a net force of zero and move at constant speed.

18a) Force Diagrams

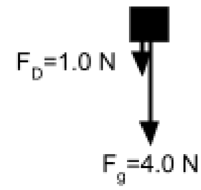
30 m



50 m



90 m



(18b) W_{NET}=+200 J;   (18c) KE_{110}=300 J

18d) L3 Speed Ranking

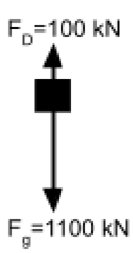
Height (m)	10	30	50	70	110
Speed Rank	1	2	3	3	2

18e) L4 Speed Ranking

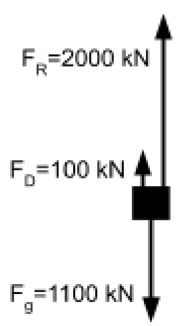
Height (m)	10	20	30	40	50	60	70	80	90	100	110
Speed Rank	1	2	3	5	7	7	7	6	5	4	3

19a) Force Diagrams

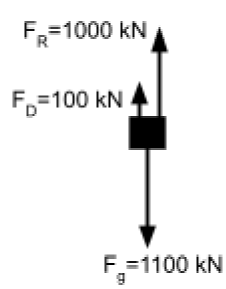
950 m



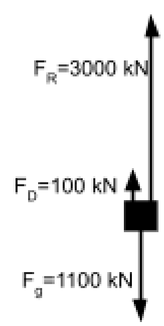
700 m



500 m



200 m



19b) Speed Ranking

Height (m)	1000	900	800	600	400	300	200	0
Speed Rank	4	5	4	3	3	3	2	1

19c) W_{NET}=-800 MJ (“M” means million);   (18d) $KE_{h=1000\ m}$=800 MJ

Lesson 3.07 (Update: 1/20/2017)

Conceptual Practice:

11. a) When walking, people push on the ground with their feet. In order to generate force to move forward, people push back on the ground which generates a friction force between the shoe and the ground. The ground responds (Newton's 3rd Law of Motion) with an equal and opposite friction force on the shoe, pushing the person forward. Since the shoe does not slide during the interaction, the friction between the shoe and the ground is "static".

b) The friction when walking does positive work because the static friction has the same direction with your motion.

12. a) When you tap the brakes (or have antilock brakes), the wheels of the car are still rotating and maintain the contact with the ground. The frictional force will be static friction since the rotation of the wheels slow down to a stop. When you lock the brakes, the wheels of the car stop rotating and start to slide. The frictional force will be sliding friction since the wheels of the car slide to a stop. Sliding friction is weaker than static.

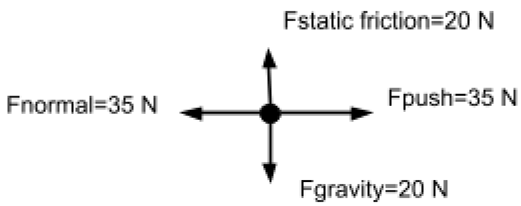
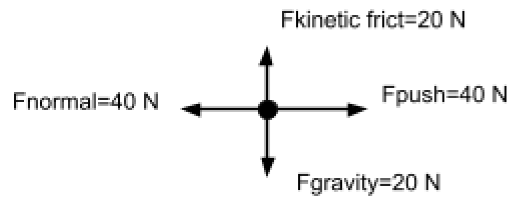
b) Because each point on the tire touches exactly one point along the surface you're moving on, you have static friction. Since static friction is larger than sliding friction, by slowing the car without skidding, you are taking advantage of the larger frictional force allowing you to stop quicker than if you skidded.

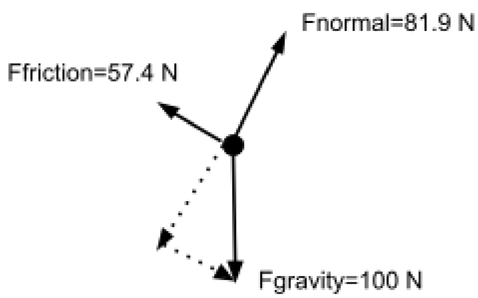
13. a) Sliding friction because the box is sliding across the floor. b) iii. If you measure static friction instead of sliding friction, then you will be assuming a larger friction force than actually present. Therefore the box will slide further.

14. B. Since the box is at rest, there will be zero net force on it. The normal force will cancel out the y component of the force of gravity, while the static friction will cancel out the x component of the force of gravity.

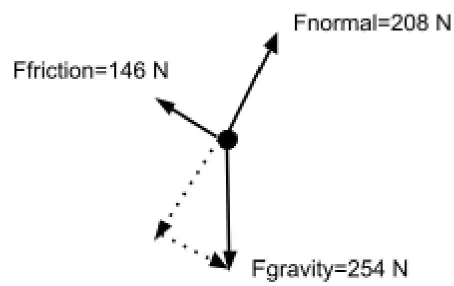
Practice Problems:

15. ai) static friction.

a)	b) kinetic friction
	



16.



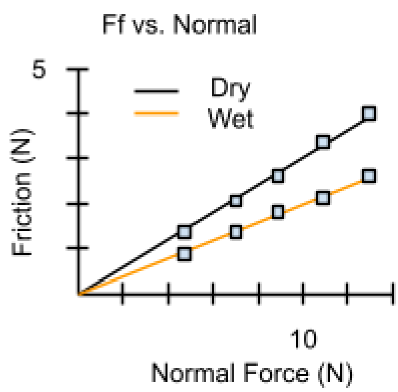
18.

17. 145 kg (if g = 10 N/kg)

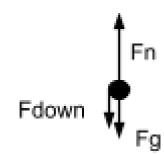
Lesson 3.8 (Update: 12/2/2015)

Conceptual Practice:

11. Group A made an error because the normal force on a pair of sneakers should not be in the range of 1000-9000 N. The group forgot to convert the mass to kilograms from grams before determining the force of gravity.

12. 

13. b

14. It creates a larger normal force which creates larger friction. 

Lesson 3.09 (Update: 12/2/2015)

<table>
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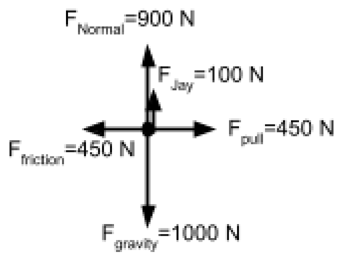
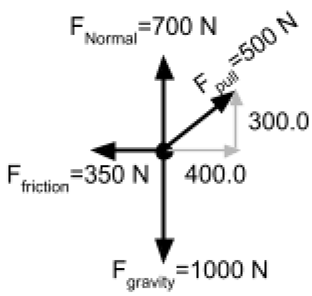
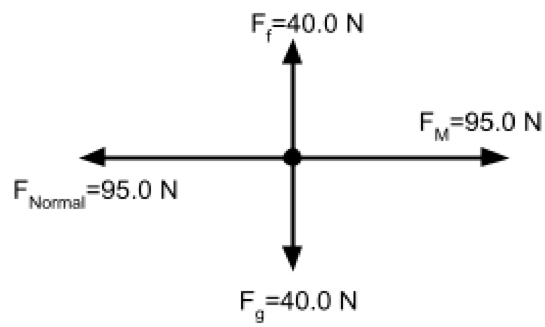
<tr><td>$F_{net,horizontal}$=0 N
$F_{net,veritcal}$=0 N</td><td>
</td><td>μ=0.50</td><td>i) True
ii) False
iii) True
iv) False

You need explanations.</td></tr>
</table>

<table>
<tr><td>4a)</td><td>5a)</td></tr>
<tr><td>

4b) v_2=3.00 m/s</td><td>

5b) μ=0.421</td></tr>
</table>

6a) iv → F_f=70.0;   b) ii - slows down

Conceptual Practice:

11.a) Water on the road will decrease the coefficient of friction between the tires and the road. A lower coefficient of friction causes the friction force to decrease, resulting in a longer stopping distance.

b) Pushing down increases the normal force on the box.

Increasing the normal force increases the force of friction acting on the box, making it harder to move.

c) You can decrease the force of friction between the furniture and the ground by pulling up on it as you push it.

Pulling up on the box will decrease the normal force between the furniture and the ground.

12. c

13. a) iii b) ii c) iii

14. a) friction decreases because of the decrease of coefficient of friction. b) friction

decreases because of the decrease of normal force. c) friction increases because of the increase of coefficient of friction. d) friction decreases because of the decrease of normal force

15. a) D, normal force increases. b) A, no change to normal force. c) C, normal force decreases. d) E, not possible. e) B, water changes the surface.

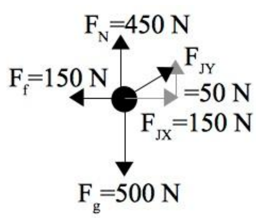
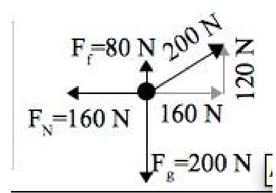
Practice Problems:

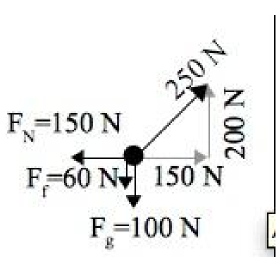
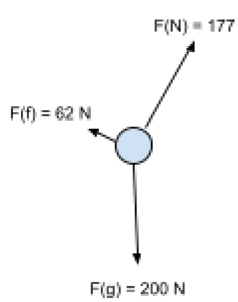
16. μ = 0.400

17. F_f = 0.26 N

18. a) W = -2500 J (b) F_f = (-)83.3 N (c) μ = 0.208

19. a) F_f = 5500 N b) v_2 = 37 m/s

20a	20b	21	22a	22b
	μ = 0.333	v_2 = 3.29 m/s		μ = 0.5

23a	23b	24a	24b	25
	v_2 = 2 m/s		v_2 = 2.17 m/s	a) all forces balanced in all three scenarios. b) unbalanced, moves uphill, Fnet=8 N uphill c) unbalanced, slides down, Fnet = 8 N downhill. d) $F_{pull,max}$=98 .0 N e) $F_{pull,min}$ =2.00 N

Lesson 3.10 (Update: 01/30/17)
Conceptual Practice:
12. a) iii b) A because when you set up the equation you will see that you need to use quadratic equation to solve for x.

Practice Problems:
13. x=0.283 m
14. a) d = 7.50 m   b) d = 4.50 m
15. a) x = 0.208 m b) x = 0.269 m

Lesson 3.11 (Update: 12/3/2015)
Slingshot!