Physics 30S

Exam Prep

January 2016

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Spring 2017

Formulas

Motion:

$d = p_2 - p_1$ $\quad v = \frac{\Delta d}{\Delta t}$ $\quad a = \frac{\Delta v}{\Delta t}$

$V_f = V_i + at$ $\quad V_f{}^2 = V_i{}^2 + 2ad$ $\quad d = V_i t + \frac{1}{2}at^2$

$d = V_f t - \frac{1}{2}at^2$ $\quad d = (\frac{V_f + V_i}{2})t$

Dynamics:

F = ma $\quad$ g=9.8m/s^2

f=μF$_N$

$a = \frac{\sum F}{\sum m}$ $\quad F_{spring} = -kx$

F$_g$=$\frac{Gm_1 m_2}{r^2}$ $g = \frac{GM}{r^2}$

Earth Information:

G= 6.673 x 10^{-11}Nm^2/kg^2

R$_{earth}$= 6368.1km

M$_{earth}$ = 5.9736 x 10^{24}kg

Electricity and Magnetism:

$F_E = \frac{kq_1q_2}{r^2}$ $\quad E = \frac{F_E}{q}$ $\quad k = 9.0X10^9 \frac{Nm^2}{C^2}$

$F_B = BIL$ $\quad F_B = qvB$ $\quad B = \frac{\mu_0 I}{2\pi r}$ $\quad \mu_0 = 4\pi X\ 10^{-7} \frac{Tm}{A}$

Waves

$v = \lambda f$ $\quad f = \frac{1}{T}$ $\quad f_D = f_S\left(\frac{v - v_d}{v - v_s}\right)$ $\quad L = \frac{1}{2}\lambda$ $\quad L = \frac{1}{4}\lambda$

$f_{obs} = f\left(1 \pm \frac{v}{c}\right)$ $\quad \Delta\Delta = (\lambda_{obs} - \lambda) = \pm \frac{v}{c}\lambda$ $\quad \theta_i = \theta_r$

$n_1 sin\theta_1 = n_2 sin\theta_2$ $\quad n = \frac{c}{v}$ $\quad sin\,\theta_c = \frac{n_2}{n_1}$

Constants

G=6.67 x 10^{-11}Nm^2/kg^2

g=9.8m/s^2

K=9.0 x 10^9 Nm^2/kg^2

Electron charge = -1.60 x 10^{-19}C

mass of electron= 9.11 x 10^{-31} kg

mass of proton = 1.67 x 10^{-27}kg

$\mu_0 = 4\pi\, x\, 10^{-7} Tm/A$

C= 3.0 x 10^8m/s

Math

$C = 2\pi r$ $\quad A = \pi r^2$

$sin\theta = \frac{O}{H}$ $\quad cos\theta = \frac{A}{H}$ $\quad tan\theta = \frac{O}{A}$

$ax^2 + bx + c$ $\quad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x^2+y^2=z^2$

Name:_____ Date:_____

Physics 11

Motion Test (40 marks)

Part A: Matching (5 marks)

1. Displacement
2. Vector
3. Velocity
4. Scalar
5. Acceleration
6. Distance
7. Meter
8. Time
9. Origin
10. Position

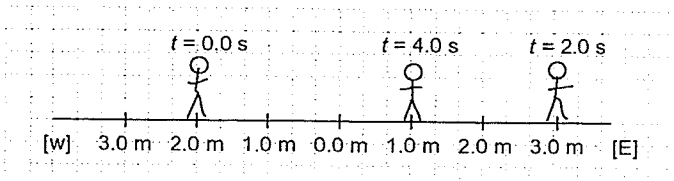
a) SI unit is g
b) A change in position
c) The change in velocity divided by the time it took to make the change in velocity.
d) SI unit for distance
e) The change in displacement divided by the time it took to make the displacement.
f) SI unit is seconds
g) A change in time
h) A quantity that has only magnitude
i) SI unit is minutes
j) The separation between an object and the origin
k) A quantity that has only direction
l) A scalar quantity that describes how far an object is from the origin.
m) The point where both variables on a coordinate system equal zero.
n) A quantity that has magnitude and direction

Part B: Multiple Choice (10marks)

1. The slope of a position-time graph represents
   A. the rate of change in velocity
   B. average velocity
   C. the rate of change in speed
   D. average speed
2. On a position-time graph, what does a line with zero slope represent?

   A. The time interval is zero.
   B. The object is moving forward at a constant speed.
   C. The object is stationary.
   D. The object is moving backward at a constant speed.

Use the following motion diagram to answer question 3.



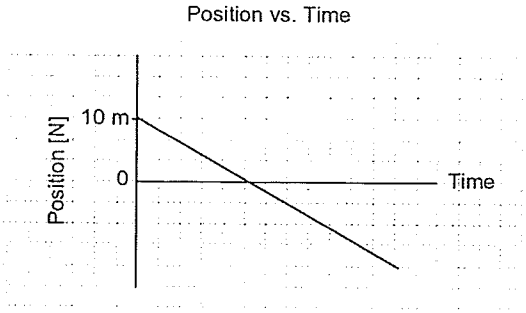
3. A boy walks from 2.0 m [W] to 3.0 m [E] in 2.0 s. He then walks to a position 1.0 m [E] in the next 2.0 s time interval, as shown below. Which of the following correctly shows the boy's distance and displacement during the time interval 0 s to 4.0 s?

	Distance	Displacement
A	3.0 m	1.0 m [E]
B	3.0 m	3.0 m [E]
C	7.0 m	1.0 m [E]
D	7.0 m	3.0 m [E]

4. Convert 75 km/h to m/s.

A. 1.3 m/s
B. 21 m/s
C. 1300 m/s
D. 75000 m/s

Use the following position-time graph to answer question 5.



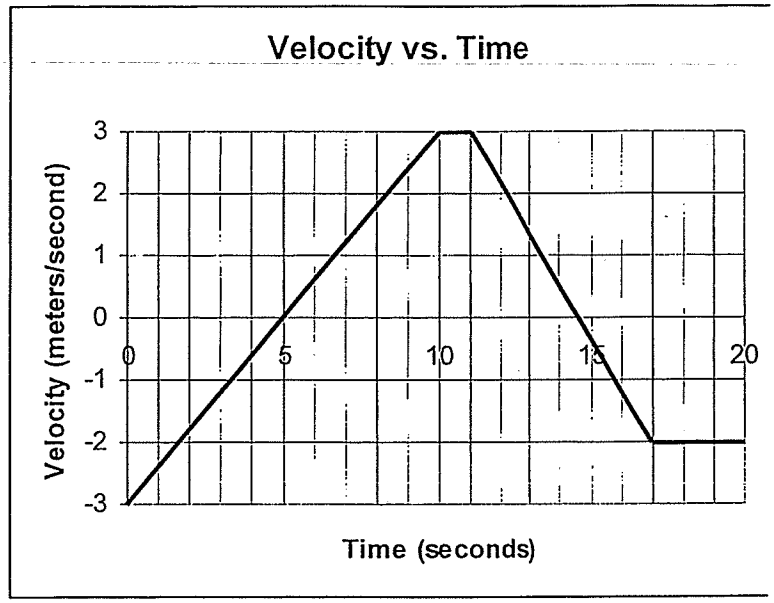
5. Which of the following statements best describes the motion represented by the position-time graph?

A. The object starts at the origin and moves 10 m [N] with uniform motion.
B. The objects starts 10 m [N] and moves south with uniform motion.
C. The object moves north with uniform motion, stops, and then moves south.
D. The object starts at the origin and moves south with uniform motion.

6. If a velocity-time graph has zero slope, you can infer that the object being observed

A. is accelerating
B. is moving with uniform velocity
C. is decelerating
D. has zero displacement

Use the graph on the right for questions 7 to 10



7. The acceleration is **constant** from 0 seconds to 20 seconds?
   a) True b) False

8. The acceleration from 11 seconds to 17 seconds is:
   a) 0 m/s^2
   b) 0.83 m/s^2
   c) -0.83 m/s^2
   d) -1.2 m/s^2

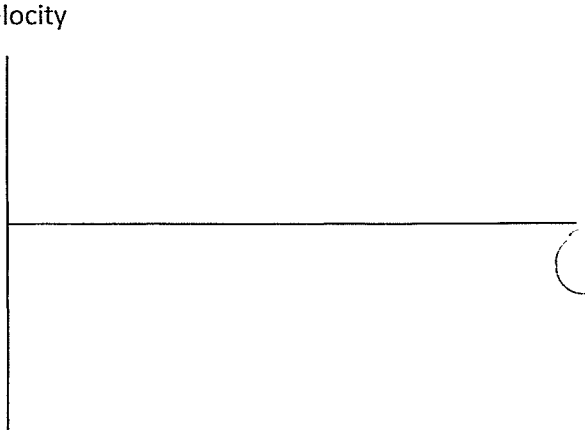
9. From 10 seconds to 11 seconds the object is not moving.
   a) True b) False

10. Calculate the displacement from 0 seconds to 11 seconds.
    a) 15 m b) 0 m c) 3 m d) 33 m

Part C: Long Answer

1. A car accelerates uniformly from 3.00 m/s to 12.0 m/s and moves a distance of 90.0 m. How long does it take the car? (4 marks)

2. Draw the following lines on the graph. (.5 mark each)
   a. A positive velocity, positive acceleration.
   b. Negative velocity, positive acceleration



3. A ball is thrown vertically downwards off of a very high bridge with a velocity of -2.00 m/s and strikes the ground 10.0 seconds later. What is the final velocity of the ball? (Hint: the acceleration of gravity is -9.8m/s^2) (4 marks)
4. In wandering, a grizzly bear makes a displacement of 1521 m due west, followed by a displacement of 3267 m east. What are (a) the magnitude and (b) the direction of the displacement needed for the bear to *return to its starting point?* (3 marks)
5. Bobby is swimming up river. He can swim with a velocity of 3m/s. The current runs against him at 0.5m/s. What is his resultant velocity? Please include a drawing. (ie: What is his actual velocity) (2mark)
6. Eason is driving his car at -30.0m/s and then accelerates for 7.0 seconds at 2.0m/s^2. He then maintains a constant velocity for the next 12 seconds. What is his displacement? (7 marks) You may want use a velocity time graph.
7. A student makes a trip from VCI to the coop which is 5.2km away. The first time they go, they have a speed of 24m/s and the second time they go, they have a speed of 14m/s. What is the student's average velocity? (4 marks)

Forces Test

Part A: Matching (4 marks): Use arrows or write the proper letter by the number.

11. Newton's First Law
12. Coefficient of Friction
13. Acceleration
14. Normal force
15. Newton's Second Law
16. Displacement
17. Newton's Third Law
18. Static Friction
19. Kinetic Friction
20. Velocity

a) The ratio between the friction force and the normal force
b) A change in position
c) The change in velocity divided by the time it took to make the change in velocity.
d) For every action, there is an equal and opposite reaction
e) The change in displacement divided by the time it took to make the displacement.
f) SI unit is seconds
g) A change in time
h) A quantity that has only magnitude
i) The amount of force the Earth pushes back on an object
j) Friction that occurs when an object is moving
k) F=ma
l) Law of Inertia
m) Friction that occurs when an object is at rest.
n) A diagram that shows the forces interacting with each other.

Part B: Multiple Choice (10marks): Circle your answer

1. Which one is **NOT** one of Newton's 3 Laws

   A. Law of Conservation of Energy
   B. Law of Inertia
   C. For every action there is an opposite and equal reaction
   D. An object will maintain its motion if no outside forces influence it

2. Which of the following is a free body diagram for an apple hanging from a tree?

a) 

b) 

c) 

d) 

3. If a car is driving forward and it suddenly stops, what happens to the driver?

   A. The driver moves forward
   B. The driver moves backwards
   C. The driver moves to the right
   D. The driver moves to the left.

4. Emily uses her finger to push a toy car on the desk. The toy car is moving with a constant velocity. If the car has a 9N weight and Emily is pushing the car with 12N to the right, what is the net force assuming no friction?

   b) 9N [down]
   c) 12N [right]
   d) 0N
   e) 3N[right]

5. A 7.0 kg rubber tire is pushed across a concrete parking lot. The coefficient of friction between the rubber and concrete is 0.50. What is the frictional force?

   e) 3.5N
   f) 175N
   g) 34N
   h) 17.5N

6. Force and acceleration are

a) directly proportional
b) indirectly proportional
c) inversely proportional
d) positively proportional

7. Acceleration and mass are
a) directly proportional
b) indirectly proportional
c) inversely proportional
d) negatively proportional

8. If Thomas accelerates at $5m/s^2$ and he has a mass of 65kg, what is his force?
a) 150N
b) 300N
c) 325N
d) 350N

9. Using Newton's third law when you jump you are
a) pulling against the Earth.
b) pushing against the Earth and the Earth pushes back against you
c) pulling on the Earth and the Earth is pulling on you.
d) pulling on the Earth and the Earth is pushing on you.

10. A spring has a force of 375N applied to it. This causes the spring to compress by 15cm. What is the spring constant?
    a. 2000 N/m
    b. 2500N/m
    c. 56N/m
    d. 57N/m

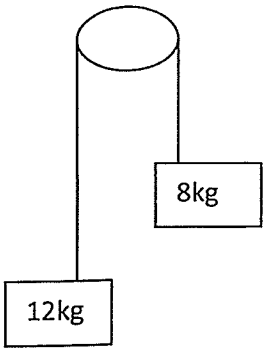
Part C: Long Answer

8. Draw a free body diagram for the following situations: (.5 mark each)

    a) The forces working on your book on your desk.
    b) Tim and Jim having a tug of war where Tim can pull harder
    c) A rocket blasting off.

9. A car weighs 15200N on Earth. What is its mass? (1mark)

10. Superman (m=107kg) is flying straight up with an acceleration of 6.50 m/s^2.
    a. Draw a free body diagram (.5 mark)
    b. What lift force must superman give to have this acceleration? (2 mark)
11. A 550 kg box is pushed across a surface with a force of 1275N. The coefficient of friction is 0.18. Calculate the acceleration. Draw a Free Body Diagram. (3 marks)
12. Lawrence Taylor, a famous linebacker) has a mass of 150kg. How much force is necessary to move him if the coefficient of static friction when he is on the field is 0.42? (2 marks)
13. Assume that a scale is in an elevator on Earth. What force would the scale exert on a 45kg person during the following situations? Draw an FBD for each
    a. The elevator slows 1.5m/s^2 while travelling up. (2 marks)
    b. The elevator moves downward at a constant speed. (1 mark)
    c. The elevator descends and speeds up with 1.5m/s^2. (2 marks)
14. Find the Acceleration in the following system. Then, find the tension. Draw an FBD. (5 marks)



Bonus(2 marks)

You must show all of your work

You are driving a 2350kg car at a constant velocity of 25m/s on a wet, straight road. You hit the brakes, the wheels lock and you slide to a stop after 60.0m. What coefficient of kinetic friction is required?

Gravitation and Friction Test

Part A: Matching (3 marks): Use arrows or write the proper letter by the number.

21. Acceleration of gravity	a) The ratio between the friction force and the normal force
22. Coefficient of Friction	b) An attraction Force
23. Acceleration	c) The change in velocity divided by the time it took to make the change in velocity.
24. Normal force	d) For every action, there is an equal and opposite reaction
25. Force of gravity	e) The change in displacement divided by the time it took to make the displacement.
26. Static Friction	f) $9.8m/s^2$
	g) A change in time
	h) A quantity that has only magnitude
	i) The amount of force the Earth pushes back on an object
	j)) Friction that occurs when an object is at rest.
	k) F=ma
	l) A Repulsion force
	m) Friction that occurs when an object is at moving.
	n) A diagram that shows the forces interacting with each other.

Part B: Multiple Choice (7 marks): Circle your answer

1. If the mass of the Earth is doubled, what happens to the force of gravity?

   A. It doubles
   B. It is halved
   C. It shrinks by a factor of 4
   D. It increases by a factor of 4

2. A woman weighing 500 N sits on the floor. She exerts a force on the floor of

a) 1000 N.

b) 500 N.

c) 250 N.

d) 50 N.

3. The mass of an object at the surface of the Earth compared to the mass of the same object at a distance of two earth radii from the surface is

a. The same

b. One quarter

c. One half

d. One ninth

11. What is the force of gravity on a satellite (m=1000kg) that is orbiting 25600km above the Earth?

i) 402N away from the Earth

j) 402N towards the Earth

k) 390N towards the Earth

l) 390N away from the earth

12. Bill starts to push against a fridge and it is not moving. We can say that

a) The static friction is stronger than Bill.

b) The kinetic friction is stronger than Bill.

c) The static friction is weaker than Bill.

d) The kinetic friction is weaker than Bill.

13. A 7.0 kg rubber tire is pushed across a concrete parking lot. The coefficient of friction between the rubber and concrete is 0.50. What is the frictional force?

a. 3.5N

b. 175N

c. 34N

d. 17.5N

14. Acceleration and mass are

a) directly proportional

b) indirectly proportional

c) inversely proportional

d) negatively proportional

Part C: Long Answer (25 marks)

15. On earth, two parts of a space probe weigh 13000 N and 7900 N. These parts are separated by a center-to-center distance of 32 m and may be treated as uniform spherical objects. Find the magnitude of the gravitational force that each part exerts on the other out in space, far from any other objects. (4 marks)

16. Calculate the acceleration due to gravity on Jupiter. The radius of Jupiter is about 71492km and its mass is 1.8986×10^{27} kg. (3 marks)

17. A space monkey weighs 380 N on earth. What will the monkey weigh on another planet whose radius is three times that of the earth and whose mass is half that of the earth? (3 marks)

18. If Tim, (mass 65.0kg) feels like he weighs 441N, how far from the surface of the Earth is he? (4 marks)

19. A boy exerts a 45.0 N horizontal force as he pulls a 72.0 N sled across a cement sidewalk at constant speed.
    a) What is the force of kinetic friction between the sidewalk and the metal sled? (1 marks)
    b) What is the coefficient of friction? (1 mark)
20. A 550 kg box is pushed across a surface with a force of 1275N. The coefficient of friction is 0.18. Calculate the acceleration. Draw a Free Body Diagram. (4 marks)
21. You are driving a 2450kg car at a constant velocity of 35m/s on a wet, straight road. You hit the brakes, the wheels lock and you slide to a stop after 76.0m. What coefficient of kinetic friction is required? (5marks) (Hint: acceleration connects motion and forces)

Name:_____ Date:_____

Physics 11

Electricity and Magnetism

Part A: Matching (4 marks): Use arrows or write the proper letter by the number.

27. Coulomb (C)
28. Conduction
29. Neutral
30. Coulomb's Constant ("k")
31. Electric Field
32. Induction
33. Tesla (T)
34. Magnetic field

a) When electrons are transferred directly by touching
b) $9.0X10^9Nm^2/C^2$
c) The change in velocity divided by the time it took to make the change in velocity.
d) When the positive and negative charges are balanced.
e) The unit for Magnetic field
f) $9.8m/s^2$
g) The unit for charge
h) A quantity that has only magnitude

i)) Friction that occurs when an object is at rest.

j) The field that exists around any charged object and can provide a force to another charged object.
k) The area around a magnet or current carrying wire where a magnetic force can be exerted.
l) When an object is charged without touching another charged object.

Part B: Multiple Choice (10marks): Circle your answer

1. Which of the following is not a method of charging objects?
    a. Friction
    b. Induction
    c. Compulsion
    d. Conduction
2. If the distance between two charged objects is double than the electric force
    a. doubles
    b. Decreased by half
    c. Decreased by a quarter
    d. Increase by a factor of 4.

3. For an electric field, The field lines are pointed
    a. In the direction a positive charge would go
    b. In the direction a negative charge would go
    c. In the direction a neutral charge would go
    d. In the direction an electron would go
4. Two electrons meet. The electric force between them is
    a. Repulsive
    b. Attractive
    c. Downward
    d. Upward

5. The north pole of a magnet points toward the earth's
    a. north pole.
    b. south pole center.
    c. middle latitudes

6. A stationary electron is in a uniform magnetic field of 0.20 T. What is the magnitude of the magnetic force on the proton?
    a. $1.6X10^{-20}$ N
    b. $3.2X10^{-20}$ N
    c. zero
    d. $1.6X10^{-21}$ N

7.A proton moving at $5.0X10^{4}$ m/s horizontally enters a region where a magnetic field of 0.12 T is present, directed vertically downward. What magnitude of force acts on the proton?
    a) zero
    b) $9.6X10^{-16}$ N
    c) $3.2X10^{-16}$ N

d) $6.4X10^{-16}$ N

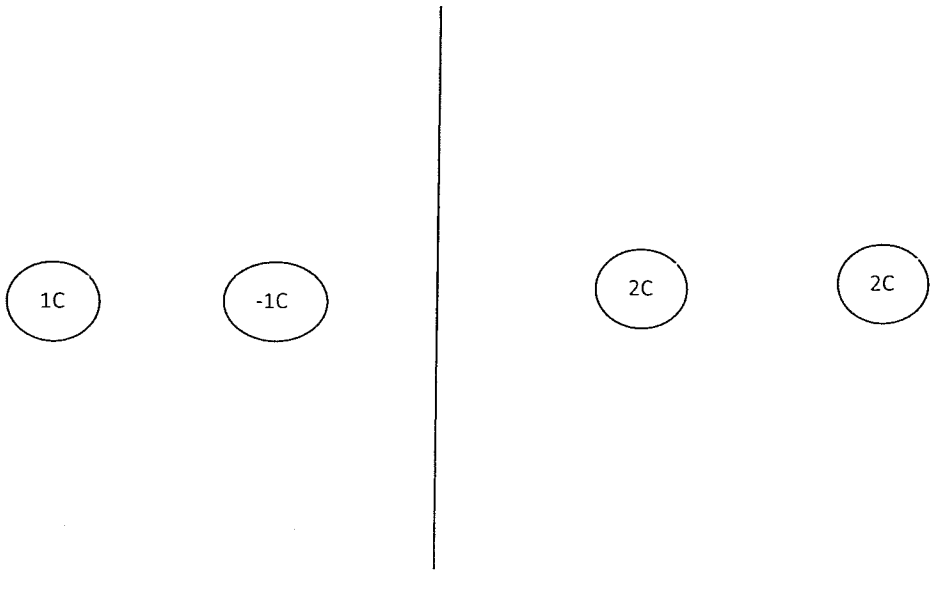
8. A vertical wire carries a current straight down in a region where the magnetic field vector points due north. What is the direction of the resulting force on this current?
   a. Down
   b. North
   c. East
   d. West

9. Two long parallel wires placed side-by-side on a horizontal table carry identical current straight toward you. From your point of view, the magnetic field at the point exactly between the two wires
   a) points up.
   b) points down.
   c) points toward you.
   d) is zero

10. A vertical wire carries a current straight down. To the east of this wire, the magnetic field points
   a. north.
   b. east.
   c. south.
   d. down.

Part C: Long Answer (26 marks)

22. What is the electric force between 17μC and -21 μC that are 3.2 $X10^{-3}$m apart? (2 marks)
23. A force of 0f $3.2x10^{2}$N exists between a positive charge of $8.3X10^{-5}$C and a positive charge of $4.0X10^{-5}$C. What is the distance between the charges? (3 marks)
24. What is the force on an electron as it travels to the West through an electric field of 175N/C that is directed downward? (2 marks)
25. Derive a formula for the electric field using charge, distance, and Coulomb's Constant (k). Hint: go from E=F/Q to $E=kq/r^2$(1 mark)
26. Please draw the field lines. (1 Mark Each)



27. A negative charge (q=-4C) is between two positive charges. The positive charges are q=5C and q=8C and they are 1m apart. If the larger charge is on the right of the negative charge, how far from the larger must the smaller charge be so that it experiences no movement? Hint: Draw a diagram (5marks)
28. A wire that is 0.75m long and carrying a current of 11.0A to the right experiences a force of 0.56N upward. What is the magnetic field strength? Please include direction. (Hint: East, West, South, North) (3 marks)
29. A thin copper rod 2.0 m long has a mass of 0.075 kg and is in a magnetic field of 0.20 T. What minimum current in the rod is needed in order for the magnetic force to cancel the weight of the rod? (3 marks)
30. An electron moving at $6.2X10^4$ m/s to the right enters a region where a magnetic field of 0.34 T is present, directed vertically upward. What force acts on the proton? (4 marks)
31. Two long parallel wires placed side-by-side on a horizontal table carry identical current straight toward you. From your point of view, the magnetic field at the point exactly between the two wires? Please draw a picture. (1 mark)