Notes about Final Exam

1. The final will be held on

Saturday, May 28, 2016 (10:00am – 12:00am) in room A1/402

2. NO electronic devices are allowed during the exam. Phones must be turned off.

3. **You are allowed to bring ONE page of notes (one sided & letter-sized 8.5" x 11") to the exam. It can be any size font as long as you can read it.**

4. The format of the exam will be:

1) multiple choice
2) short answer to the question
3) problems (from Chp. 2 & 3)

Some sample questions have been included at the end of this review.

5. Your overall grade will be determined as follows (The lowest score from the quizzes will be dropped):

Home Work:	15%
Lab Assignments:	15%
Quizzes:	45%
Final Exam:	25%
TOTAL:	100%

Final Exam Review

The final exam is cumulative. It will include everything covered in the lectures, labs and homework assignments. The lecture notes and homework assignments can be found at http://www.sci.brooklyn.cuny.edu/~dzhu/phs101/. The lecture notes provide an outline of what we have learned in this semester. The text book, **The Physical Universe**, provides the detailed description and should be used to better understand the contents covered in the class.

The chapters and the sections that we have covered are listed below:

Chp. 1: The Scientific Method (1.1 ~ 1.12)

Chp. 2: Motion (2.1 ~ 2.5, 2.7 ~ 2.14)

Chp. 3: Energy (3.1 ~ 3.5, 3.8, 3.10 ~ 3.13)

Chp. 5: Matter and heat (5.1 ~ 5. 13)

Chp. 6: Electricity and Magnetism (6.1 ~ 6.19)

Chp. 14: Atmosphere and Hydrosphere (14.1 ~ 14.11)

Chp. 17: The Solar System (17.1 ~ 17.16)

Chp. 18: The Stars (18.4 ~ 18.8, 18.10 ~ 18.16)

Sample Final Exam Questions

MULTIPLE CHOICE (about 60%)

1. When saturated air is cooled,

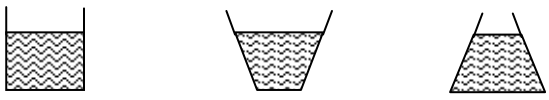
   a. it becomes able to take up more water vapor.
   b. some of its water content condense out.
   c. the relative humidity goes down.
   d. convection currents result.

2. The surface temperature of the sun is approximately

   a. 600 K.
   b. 6000 K.
   c. 6 million K.
   d. 14 million K.

SHORT ANSWER (about 10%)

3. The three containers shown below are filled with water of the same height. Compare the water pressures at the bottom of the containers.



(a) *(b)* *(c)*

4. What happens to the radiation emitted underneath the photosphere of the sun?

PROBLEMS (about 30%) – from Chps. 2 & 3 Only

Important Formulas

Pythagorean theorem for right triangle (C is longest side): $A^2 + B^2 = C^2$

Speed: $v = \frac{d}{t}$

Acceleration: $a = \frac{v_2 - v_1}{t}$

$d = v_1 t + \frac{1}{2} a t^2$

$h = \frac{1}{2} g t^2$

Second law of motion: $F = ma$

Weight: $w = mg$

Centripetal force: $F_c = \frac{mv^2}{r}$

Centripetal acceleration: $a_c = \frac{v^2}{r}$

Law of gravity: $F = \frac{Gm_1m_2}{R^2}$

5.

An airplane needed 20 s to take off from a runway 500 m long. What was its acceleration (assumed constant)? Its final speed?

Solution

Since the airplane started from rest, $v_1 = 0$ and $d = \frac{1}{2} a t^2$. Therefore its acceleration was

$$a = \frac{2d}{t^2} = \frac{2\,(500\text{ m})}{(20\text{ s})^2} = 2.5\text{ m/s}^2$$

The airplane's final speed was

$$v_2 = v_1 + at = 0 + (2.5\text{ m/s}^2)(20\text{ s}) = 50\text{ m/s}$$

Important Formulas

Work: $W = Fd$

Power: $P = \frac{W}{t} = Fv$

Kinetic energy: $\text{KE} = \frac{1}{2}mv^2$

Gravitational potential energy: $\text{PE} = mgh$

Work-energy theorem: $W_{\text{input}} = \Delta\,\text{KE} + \Delta\,\text{PE} + W_{\text{output}}$
(Δ = "change in")

Linear momentum: $\mathbf{p} = m\mathbf{v}$

Rest energy: $E_0 = mc^2$

6.

A girl on a swing is 2.2 m above the ground at the ends of her motion and 1.0 m above the ground at the lowest point. What is the girl's maximum speed?

Solution

The maximum speed v will occur at the lowest point where her potential energy above this point has been entirely converted to kinetic energy. If the difference in height is $h = (2.2\text{ m}) - (1.0\text{ m}) = 1.2\text{ m}$ and the girl's mass is m, then

$$\text{Kinetic energy} = \text{change in potential energy}$$

$$\tfrac{1}{2}mv^2 = mgh$$

$$v = \sqrt{2gh} = \sqrt{2(9.8\text{ m/s}^2)(1.2\text{ m})} = 4.8\text{ m/s}$$

The girl's mass does not matter here.