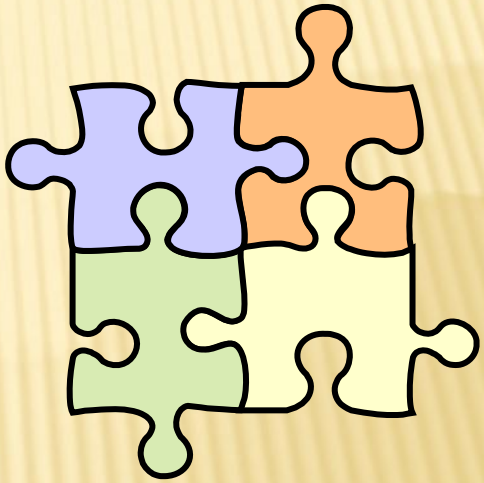


Law Man Wai
Po Leung Kuk 1983 Board of Directors'College

NSS PHYSICS PRACTICAL WORK

PREPARATION STAGE

- Training of basic techniques
- Improving working attitude

FORM 4

- Part of the internal assessment
- 1 project
- 2 group experiments
- 1 individual experiment

SOLAR OVEN

NSS F.4 Project

Making a solar cooker

Solar cooking is an environmental friendly way of cooking food. It is actually used in some countries where sunshine is plentiful. Most commercial solar cookers can reach temperature of over 100 °C, i.e., hot enough to boil water. In this project, you are asked to build a solar cooker which can be used to heat 100 cm^3 of water. The objective is to reach *the highest temperature* within a specified time.

(http://en.wikipedia.org/wiki/File:Solar-Panel-Cooker-in-front-of-hut.jpg)

Rules and limitations

1) You should not use polystyrene or foam plastic which are environmentally unfriendly.
2) You should not use any ready make kit which can function as a solar cooker.
3) It is highly recommended to use reuse materials (e.g. old newspaper, used cartoon boxes) as the materials of the solar cooker. Higher marks will be awarded for using environmental friendly materials.
4) The size of the cooker should not be larger than 1.0 m x 1.0 m x 1.0 m.
5) The cooker cannot use any power source (e.g. battery or burning fuel) other than solar energy.
6) There should be a container to hold 100 cm^3 of water. At the end of the test, there should be at least 50 cm^3 of water remains.

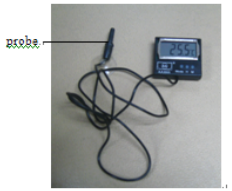
Schedule

30/10/2009 Submit the design plan of the solar cooker.
13/11/2009 Testing of the solar cooker.
20/11/2009 Submit a group report of the project.

Hints and guideline

1. You should apply what you have learned in Book 1 of Physics, including heat conduction, convection, radiation and greenhouse effect.
2. Should we use a conductor or insulator to make the insulator? A good conductor can collect heat more easily but an insulator avoids heat loss. The point is you should use the correct materials at the different positions.
3. You will be provided with a glass plate (30 cm x 30 cm) and a digital thermometer. The thermometer has a sensor probe and it should be placed in the container of water.

Glass plate



Digital thermometer

4. The solar energy collected by the solar cooker depends on the overall area of the collection surface. A larger collector will get more energy. However you need to design a way to bring the solar energy to the container of water.
5. Notice that the sun moves and you need to consider the best angle to collect the sunlight.

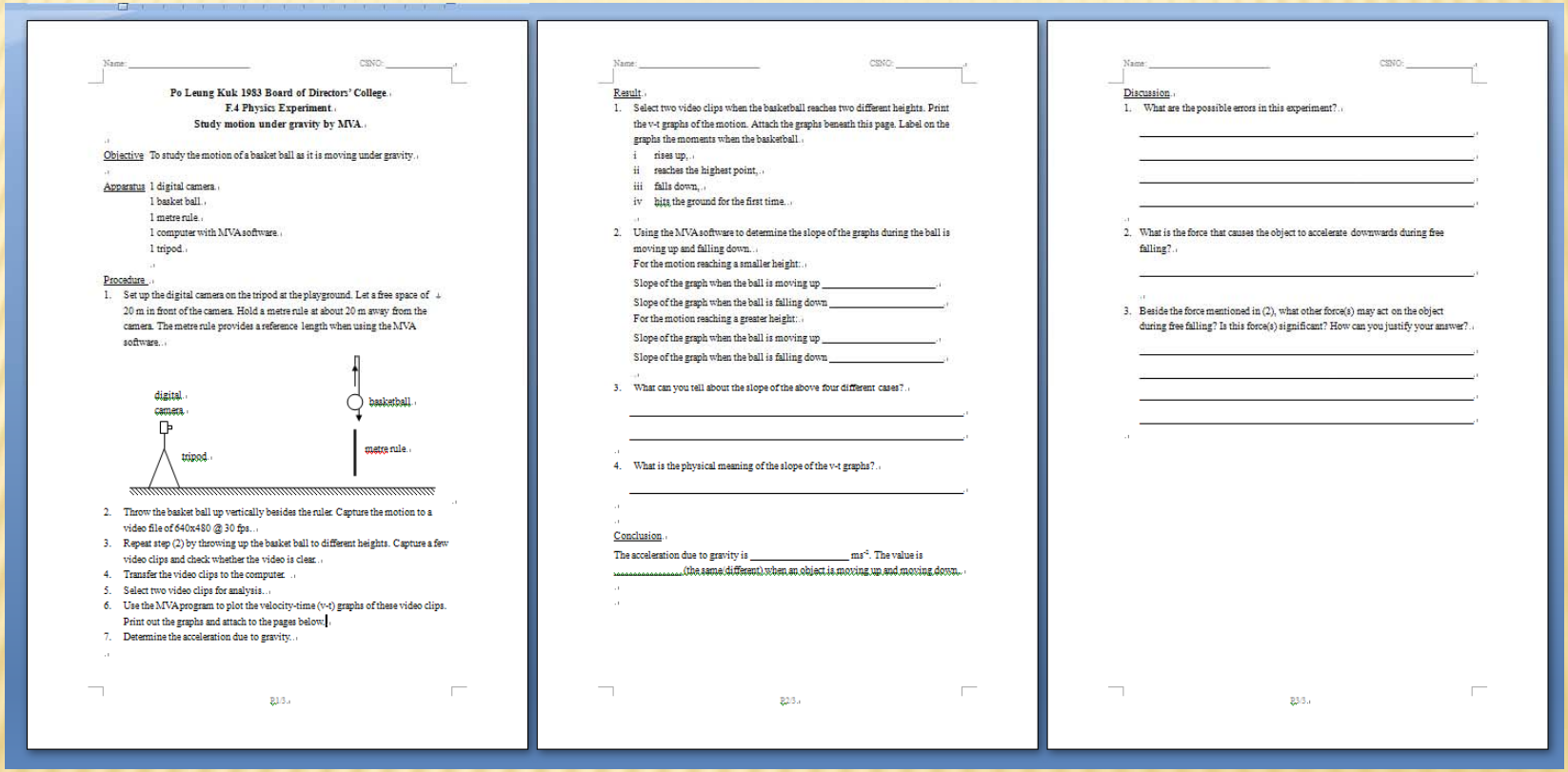
Marking criteria

1. 30% for the overall design. The design should correctly apply the theory of Physics.
2. 30% for the actual performance of the cooker. This includes the actual temperature reached and the performance of the practical session.
3. 30% for the written report. This includes the presentation, explanation and appropriate conclusion made.
4. 10% for the creativity of the design.

Reference

http://en.wikipedia.org/wiki/Solar_cooker.

MOTION UNDER GRAVITY (MVA)



Name: _____ CSNO: _____

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F.4 Physics Experiment
Study motion under gravity by MVA

Objective To study the motion of a basket ball as it is moving under gravity.

Apparatus 1 digital camera.
1 basket ball.
1 metre rule.
1 computer with MVA software.
1 tripod.

Procedure

1. Set up the digital camera on the tripod at the playground. Let a free space of 20 m in front of the camera. Hold a metre rule at about 20 m away from the camera. The metre rule provides a reference length when using the MVA software.

2. Throw the basket ball up vertically besides the ruler. Capture the motion to a video file of 640x480 @ 30 fps.
3. Repeat step (2) by throwing up the basket ball to different heights. Capture a few video clips and check whether the video is clear.
4. Transfer the video clips to the computer.
5. Select two video clips for analysis.
6. Use the MVA program to plot the velocity-time (v-t) graphs of these video clips. Print out the graphs and attach to the pages below.
7. Determine the acceleration due to gravity.

P.1/3

Name: _____ CSNO: _____

Result

1. Select two video clips when the basketball reaches two different heights. Print the v-t graphs of the motion. Attach the graphs beneath this page. Label on the graphs the moments when the basketball
   i rises up,
   ii reaches the highest point,
   iii falls down,
   iv hits the ground for the first time.
2. Using the MVA software to determine the slope of the graphs during the ball is moving up and falling down.
   For the motion reaching a smaller height:
   Slope of the graph when the ball is moving up _____
   Slope of the graph when the ball is falling down _____
   For the motion reaching a greater height:
   Slope of the graph when the ball is moving up _____
   Slope of the graph when the ball is falling down _____
3. What can you tell about the slope of the above four different cases?
   _____
   _____
4. What is the physical meaning of the slope of the v-t graphs?
   _____

Conclusion

The acceleration due to gravity is _____ ms^{-2}. The value is _____ (the same/different) when an object is moving up and moving down.

P.2/3

Name: _____ CSNO: _____

Discussion

1. What are the possible errors in this experiment?
   _____
   _____
   _____
   _____
2. What is the force that causes the object to accelerate downwards during free falling?
   _____
3. Beside the force mentioned in (2), what other force(s) may act on the object during free falling? Is this force(s) significant? How can you justify your answer?
   _____
   _____
   _____
   _____

P.3/3

DETERMINE G BY A PENDULUM

Name: _____ ( ) _____

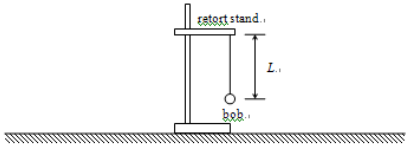
Po Leung Kuk 1983 Board of Directors' College
F.4 Physics Experiment
Determine the acceleration due to gravity by a pendulum

Objective To determine the acceleration due to gravity.

Apparatus 1 pendulum bob
1 string
1 stop watch
1 metre rule
1 retort stand

Procedure

1. Set up the apparatus as shown below. The distance between *the centre* of the bob to the suspension point should be 0.5 m. This is denoted as L.



2. Set the pendulum to swing with a small amplitude. Use the stop watch to measure the time of 20 oscillations. (By *one oscillation*, we mean the bob to go from one side to the other and back to original side.)
3. Repeat the experiment with L = 0.3 m and L = 0.7 m.
4. Write the results in the table below.

Result

L/m	0.3	0.5	0.7
Time for 20 oscillations/s			
Time for one oscillation/s			

Name: _____ ( ) _____

The time for one oscillation is denoted as T. It is known that T, L and g are related by

$$T = 2\pi\sqrt{\frac{L}{g}}$$

1. Write down g in terms of L and T.

_____

_____

_____

2. Find the values of g in the tables below.

L/m	0.3	0.5	0.7
g/ms^{-2}			

3. What can you tell about the values of g in these three different cases?

_____

_____

Conclusion

The acceleration due to gravity is _____ ms^{-2}.

Discussion

1. What are the possible errors in this experiment?

_____

_____

_____

_____

2. Why do we count 20 oscillations instead of one oscillation to find T?

_____

_____

_____

MOMENT OF LEVER

Name: _____ CSNO: _____

Po Leung Kuk 1983 Board of Directors' College
F.4 Physics Practical Examination
2009/10

Time allowed: 15 minutes

Apparatus

1	wooden bar with pivot and string knob	1	ruler
1	spring balance	1	stand and clamp
1	unknown mass		

* Put down the number on the label of the unknown mass: _____

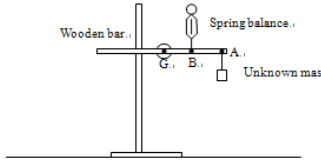
Procedures

1. Measure the distance between the *centre* of holes G and A. Repeat for holes G and B.

   GA = _____ cm

   GB = _____ cm

2. Fix the pivot G of the wooden bar on the stand and clamp. Attach the unknown mass to A and the spring balance to B. Hold the spring balance vertically until the wooden bar is horizontal. Take the reading of the spring balance F.



   Spring balance reading F = _____ N

3. Weight of the unknown mass = $F \times \frac{GB}{GA}$

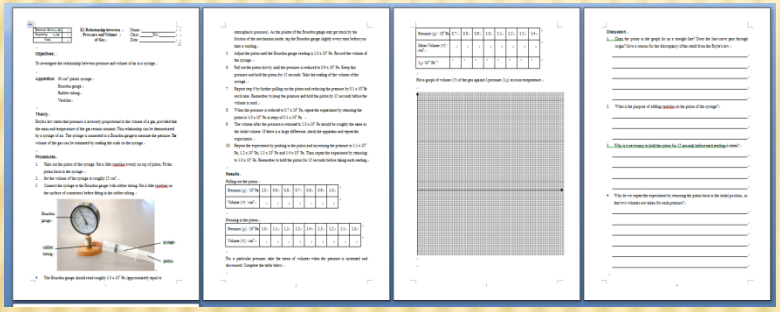
   = _____ N

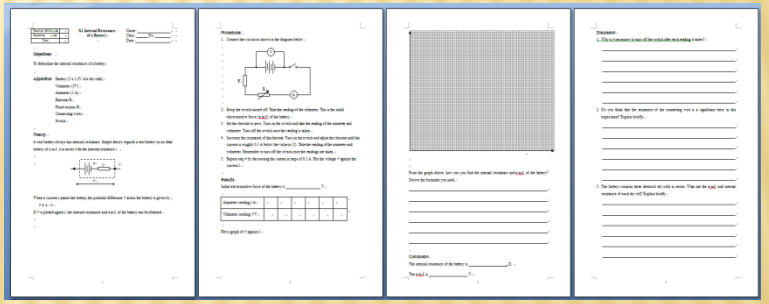
AL TAS V.S. NSS SBA

- General technique of students is lower.
- Need more assistance and instruction.
- Variation among students is large.
- Experiments are short and hard to assess technique (Area A).
- Experiments are simple and seldom need 4 or 5 students to work together.

FORM 5

- 2 experiments and 1 project
- *Relationship between pressure and volume of gas*
- *Internal resistance of a battery*





CHOICE OF EXPERIMENTS

- Solid theory background
- Appropriate difficulty
- Need measurement technique
- Common apparatus
- Easy to assess
- Graphical technique

AREA OF CONCERN

- Number of students per group
- Laboratory arrangement and time arrangement
- Percentage of Area A and Area B
- Fairness
- Assessment for learning

The End