15TH ASIAN PHYSICS OLYMPIAD
11 - 18 MAY 2014, SINGAPORE

# Experimental Competition
# May 15, 2014
# 0830 - 1330 hrs

## Answer Sheets Cover Page

## STUDENT CODE

| | | | |
|---|---|---|---|
| | | | |

**Additional Number of writing sheets =** ____

*Do not write below this line.*

| | Part A | Part B | Part C | Part D | Total |
|---|---|---|---|---|---|
| **Maximum allotted marks** | 6.5 | 6.0 | 5.0 | 2.5 | 20.0 |
| **Marks Scored** | | | | | |

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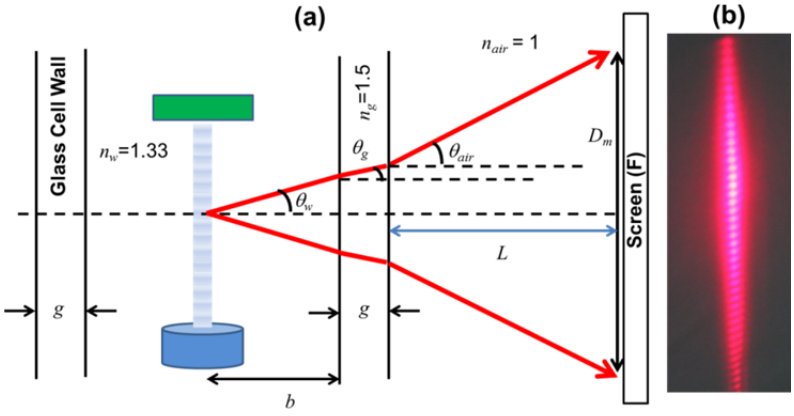
**Experiment A:**

**A1.** An expression for $\lambda_s$ is given by the equation:

$$\lambda_s = A(m-1)\frac{n_{air}\lambda_{air}}{D_m}$$

In the space below, **determine A** in terms of ($b$, $g$, $n_w$, $n_g$, $\lambda_{air}$, and $L$,) under small angle approximation condition.




1.5

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**A2.** Attach this Answer Sheet A2 to the Screen (F) and mark the fringes in the space below. 2.5

**Do not forget to note down the relevant experimental parameters, in Answer Sheet A3 as well, needed for calculations**.

| | |
|---|---|
| $m$ = | |
| $D_m$ = | |
| Temperature of the mineral water | |

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| | | |
|---|---|---|
| **A3.** | Measure and record all relevant parameters in the space below and calculate the wavelength of sound, $\lambda_s$, in mineral water.<br><br>$\lambda_s =$ | 1.0 |
| **A4.** | Calculate and record the frequency of ultrasonic waves, $f_s$, in mineral water.<br><br>$f_s =$ | 0.5 |

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| | | |
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| **A5.** | Carry out an error analysis to estimate the uncertainty, $\Delta f_s$, in the frequency of ultrasonic wave. | 1.0 |

| | |
|---|---|
| $\Delta f_s =$ | |

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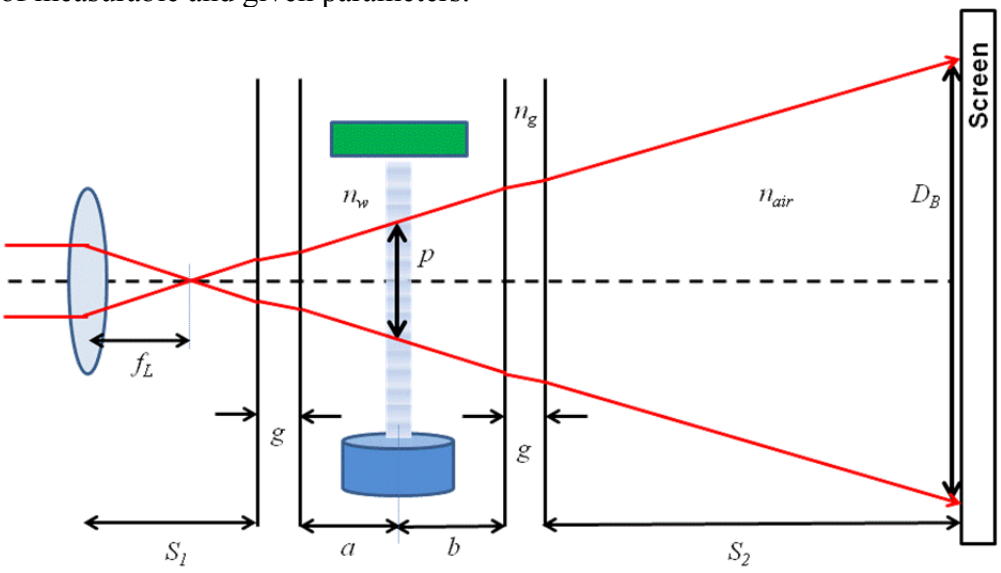
## Experiment B

| | | |
|---|---|---|
| **B1.** | Assume that the number of bright regions counted within the length $D_B$ on screen is $m_B$.<br><br>Use equation (3) from the question paper, to write the expression for $\lambda_s$ in terms of measurable and given parameters.<br><br>  <br> | 1.0 |

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**B2.** Attach this Answer Sheet B2 to the Screen (F) and mark the projected standing wave pattern in the space below. 2.0

**Do not forget to note down the relevant experimental parameters, in Answer Sheet B3 as well, needed for calculations.**

| | |
|---|---|
| $m_B$ = | |
| $D_B$ = | |
| Temperature of the mineral water | |

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| | | |
|---|---|---|
| **B3.** | Measure and record all relevant parameters in the space below and calculate the wavelength of sound, $\lambda_s$, in mineral water.<br><br>$\lambda_s =$ | 1.5 |
| **B4.** | Calculate and record the frequency of ultrasonic waves, $f_s$, in mineral water.<br><br>$f_s =$ | 0.5 |

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| **B5.** | Carry out an error analysis to estimate the uncertainty, $\Delta f_s$, in frequency of ultrasonic wave. | 1.0 |

| | |
|---|---|
| $\Delta f_s =$ | |

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## Experiment C

**C1.** Attach this Answer Sheet to the Screen (F) and mark the observed patterns in the space below. (1.0)

Tick in the box below for the experimental method that you have adopted for this question:

| Experiment A (Diffraction Method) | | Experiment B (Projection Method) | |
|---|---|---|---|

Label each recorded pattern with the corresponding salt concentration. ***Do not forget to note down the relevant experimental parameters, in Answer Sheet C2 on page 10, needed for calculations.***

If additional sheets are needed for marking please use the Writing Sheets

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**C2.** Measure and record all relevant parameters in the table below and calculate the speed of sound, $v_s$, in each of the known salt concentration. 2.0

$C_s$ – Salt Concentration

T – Temperature of Salt Solution

$v_s$ – Speed of sound in salt solution

The third column can be divided into suitable numbers of column to record other relevant parameters.

| **$C_s$** | **T** | | **$v_s$** |
|---|---|---|---|
| | | | |

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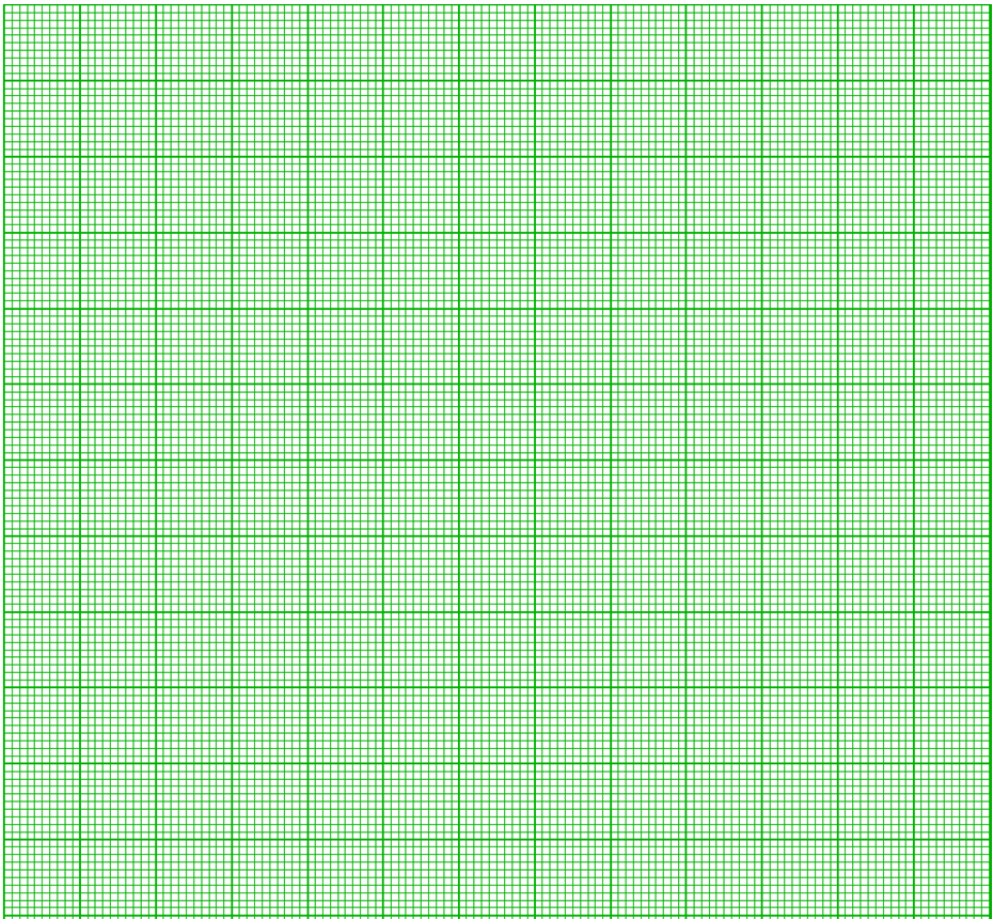
| **C3.** | Plot the speed of sound in solution against the salt concentration of the solution. Include error bars, assuming that the percentage error is the same as that obtained in Experiment A or Experiment B, for each data point  | 1.0 |

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| **C4.** | Attach this Answer Sheet to the Screen (F) and mark the observed patterns in the space below for unknown salt concentration solution.<br>Note down the temperature of the solution and all other relevant experimental parameters needed for calculation of the speed of sound in this solution.<br><br>$v_s$ in unknown solution = | 0.8 |

| | | |
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| **C5.** | Determine the salt concentration in the unknown solution. Write down your answer along with the uncertainty.<br><br>Concentration of Salt in Unknown Solution = | 0.2 |

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**Experiment D:**

| | | |
|---|---|---|
| **D1.** | Draw a labeled sketch of the experiment you have designed for calculation of the refractive index of the corn-syrup.<br>Use the space below to record relevant parameters and their values and calculate the refractive index of the corn-syrup.<br><br>$n_{corn\text{-}syrup} =$ | 1.5 |

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| **D2.** | Attach this Answer Sheet to the Screen (F) and mark diffraction patterns in the space below for corn-syrup.<br>Note down the temperature of the corn-syrup and all other relevant experimental parameters needed to calculate the speed of sound in this solution. | 1.0 |

| | |
|---|---|
| $v_s$ in corn-syrup = | |

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# Writing Sheet

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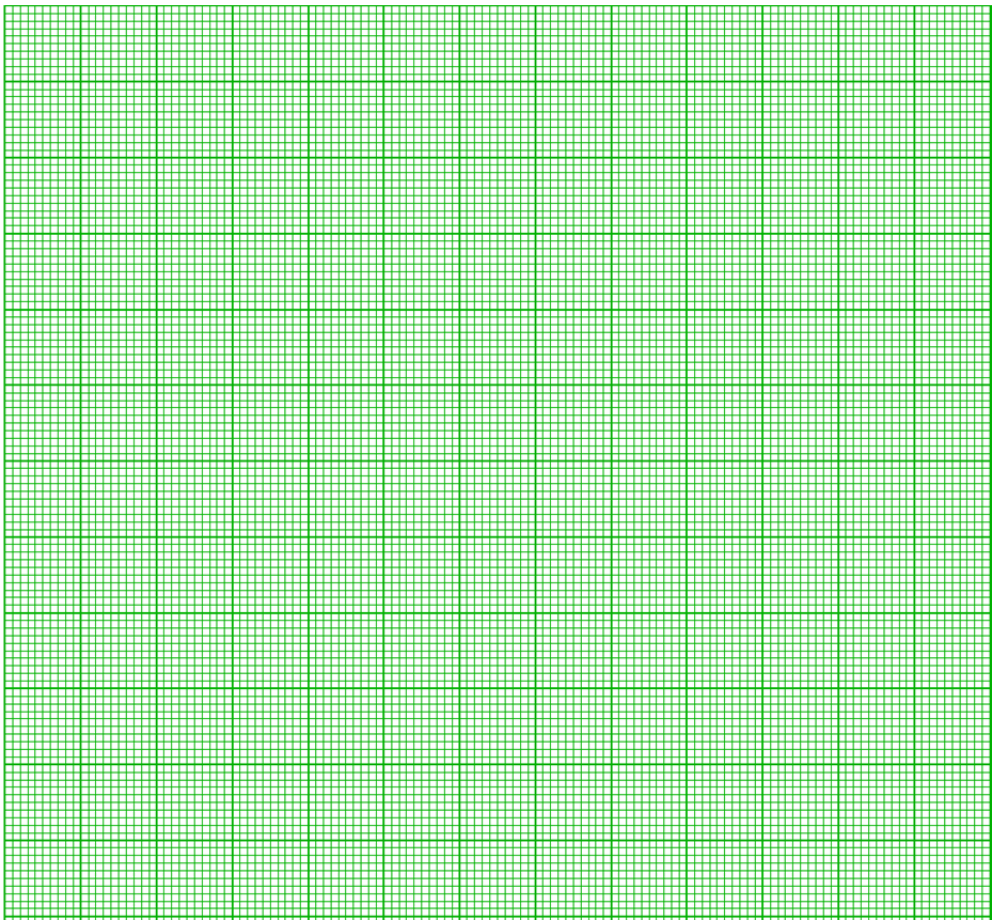

# Writing Sheet

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