

## General instructions

### Software for the online experiment

- On clicking the START EXAM button, a window will popup to start screen recording.
- You will have to share your entire screen. Sharing just a window or a tab will not allow you to access the simulations.
- Only after the screen recording starts, you will be able to see the simulation.
- After permitting to share your screen, a dialogue box at the bottom will appear with two options - "Stop sharing" and "Hide". Click on "Hide" to hide this dialogue box.
- There will be options for refreshing the simulation and switching between the 2 simulations
- Once the examination ends, please click on the finish button.
- Ending screen sharing prematurely may immediately result in revoking your authorization.
- **Your screen is being recorded all the time. Any unauthorized activity such as opening another Window/Tab/Program etc. will result in disqualification.**
- If you accidentally click the finish button or your system crashes, you may log in again to finish the exam. Later this will be reviewed through logs and may result in disqualification if you log out without any valid reason.
- If the simulation freezes, please try the following: 1. Click the "REFRESH" button (next to the "FINISH" button) 2. If the "REFRESH" button is also unresponsive, try refreshing the website (refresh icon next to the URL bar) 3. If point 2 did not work, close the browser and login again. Note that this will be reviewed post exam.
- Sometimes, there maybe overlap between controls (and inputs) and the graphics region. In such a case: 1. Please zoom out to 100% (default zoom) (Ctrl+ 0). 2. Press the "REFRESH" button (next to the "FINISH" button). 3. Now, you can zoom back without overlap.

Repeat the above process if the overlap repeats.

### Before the exam

- For the experiment exam, three A4 size envelopes are marked as Q1, Q2, and General instructions.
- You will also find your student code written on the envelope.
- You must not open the envelopes containing the problems before the sound signal indicating the beginning of the competition. The beginning and end of the examination will be indicated by a sound signal.
- There will be announcements by the supervisor at 11:55(Before the exam begins), 12:00(To indicate the start of the exam), 16:30(Before the final sound signal), and 17:00(To indicate the end of the exam).

### During the exam

- Five minutes prior to the scheduled time of the examination (11:55) the supervisors will send a suitable signal by ringing a bell etc to open the envelopes. At this time, you may log in to the exam portal.

## Experiment



# G0-2

Official (English)

- **Your screen is being recorded all the time. Any unauthorized activity such as opening another Window/Tab/Program etc will result in disqualification.**
- You should make sure to have a complete set of questions, answer sheets, and general instructions, marked with your student code on them.
- The exam starts at 12:00 IST.
- Dedicated answer sheets are provided for writing your answers. Write your answers into the appropriate tables, boxes, or graphs on the corresponding answer sheet (marked A). For every problem, there are extra blank working sheets for carrying out detailed work (marked W). Be sure to always use the working sheets that belong to the problem you are currently working on (check the problem number in the header). If you have written something on any sheet which you do not want to be graded, cross it out. Only use the front side of every page.
- In your answers, try to be as concise as possible: use equations, logical operators, and sketches to illustrate your thoughts whenever possible. Avoid the use of long sentences.
- In the tasks, error estimation is **not** required. You should decide on the appropriate number of data points or measurement repetitions unless specific instructions are given. Please give an appropriate number of significant figures when stating numbers.
- Often, you may be able to solve later parts of a problem without having solved the previous ones.
- A list of physical constants is given on the next page.
- You are not allowed to leave your working place without permission. If you need any biological break, please draw the attention of a team guide by raising your placard.
- At 16:30 hrs, the supervisors shall make a suitable indication that the examination will end in thirty minutes.
- A final signal will be given at 17:00 indicating the end of the examination.

### At the end of the exam

- After the final signal is received at 17:00, Students should stop writing immediately and place all the answer scripts and working sheets even if they are empty in the designated envelopes. For example, the envelope for Q1 must contain only the answer scripts and working sheets for Q1. Place question papers and general instructions in the third envelope marked as general instructions.
- Leave your writing equipment on the table.
- Wait at your table in silence until your envelopes are collected. Once all envelopes are collected your guide will escort you out of the examination area.

## Physical constants

Acceleration due to gravity	$g$	$= 9.81 m \cdot s^{-2}$
Boltzmann constant	$k_B$	$= 1.38 \times 10^{-23} J \cdot K^{-1}$
Current Mass of the Sun	$M_s$	$= 2.00 \times 10^{30} kg$
Current Radius of the Sun	$R_s$	$= 7.00 \times 10^8 m$
Magnitude of the electron charge	$e$	$= 1.60 \times 10^{-19} C$
Mass of the electron	$m_e$	$= 9.11 \times 10^{-31} kg$
Mass of the proton	$m_p$	$= 1.67 \times 10^{-27} kg$
Mass of the neutron	$m_n$	$= 1.67 \times 10^{-27} kg$
Permeability of free space	$\mu_0$	$= 1.26 \times 10^{-6} T \cdot m \cdot A^{-1}$
Permittivity of free space	$\epsilon_0$	$= 8.85 \times 10^{-12} F \cdot m^{-1}$
Planck's constant	$h$	$= 6.63 \times 10^{-34} J \cdot s$
Avogadro Constant	$N_A$	$= 6.02 \times 10^{23} mol^{-1}$
Stefan-Boltzmann constant	$\sigma$	$= 5.67 \times 10^{-8} W \cdot m^{-2} \cdot K^{-4}$
Universal gas constant	$R$	$= 8.31 J \cdot mol^{-1} \cdot K^{-1}$
Universal Gravitational constant	$G$	$= 6.67 \times 10^{-11} N \cdot m^2 \cdot kg^{-2}$
Wien's constant	$b$	$= 2.90 \times 10^{-3} m \cdot K$
In 2	$\approx$	0.69
In 3	$\approx$	1.10
In 10	$\approx$	2.30
Base of the Napierian logarithm $e$	$\approx$	2.72