UGANDA NATIONAL EXAMINATIONS BOARD (UNEB)

Uganda Advanced Certificate of Education

PHYSICS

Paper 2 (Practical)

Time: 2 hours 30 minutes (including 15 minutes for planning)

INSTRUCTIONS TO CANDIDATES

- This paper consists of **three** examination items.
- Answer **two** items.
- **Item 1 is compulsory**.
- You are provided with the apparatus listed for the chosen item.
- Write a **full scientific report** for each investigation you carry out.
- Use the graph paper provided where necessary.
- Record all observations and measurements clearly in suitable tables.
- Show clear working, state assumptions, and consider uncertainties where relevant.

Item 1 (Compulsory)

A construction company is investigating factors affecting the period of oscillation of long suspension cables used in bridge construction for safety and design purposes.

You are provided with:

- A pendulum bob
- Inextensible string (about 1.5 m long)
- Metre rule
- Stopwatch or stop clock
- Retort stand and clamp
- Split cork or two small pieces of wood
- Protractor (if needed)

Carry out an investigation to determine the acceleration due to gravity (g) at your location using a simple pendulum.

In your report, include the following:

1. Aim of the investigation.
2. Variables: Independent, dependent, and controlled.
3. Hypothesis.
4. Apparatus and materials used.
5. Procedure (step-by-step, including how you set up the pendulum and took measurements).

6. Results: Record data in a suitable table (use at least six different lengths L; time 20 oscillations for each length; calculate T and T^2).
7. Graph: Plot T^2 (vertical axis) against L (horizontal axis). Draw the line of best fit.
8. Analysis and calculations: Determine the slope of the graph and calculate g. Show your working clearly.
9. Sources of error (at least two) and how they can be minimised.
10. Precautions (at least two).
11. Conclusion and real-life application related to the scenario.

Item 2

A solar energy technician is testing storage batteries to be used in a community solar power project. The performance of the battery depends on its electromotive force and internal resistance.

You are provided with:

- Potentiometer wire (1 m) with scale
- Driving cell (e.g., 2 V accumulator)
- Test cell (unknown e.m.f. and internal resistance)
- Galvanometer
- Jockey/sliding contact
- Resistance box or set of known resistors
- Connecting wires and switch
- Voltmeter (if needed for checking)

Carry out an investigation to determine the e.m.f. and internal resistance of the test cell using the potentiometer method.

In your report, include the following:

1. Aim of the investigation.
2. Variables: Independent, dependent, and controlled.
3. Hypothesis.
4. Apparatus and materials used (include a description of the circuit).
5. Procedure (step-by-step).

6. Results: Record data in a suitable table (use at least four different values of resistance).
7. Graph: Plot the appropriate graph to obtain a linear relationship.
8. Analysis and calculations: Determine the internal resistance r and e.m.f. E from the graph. Show your working.
9. Sources of error and how they can be minimised.
10. Precautions.
11. Conclusion and real-life application in renewable energy systems.

Item 3

An optician is testing convex lenses for use in a new eye-testing instrument. The focusing power of the lens depends on its focal length.

You are provided with:

- Convex lens (in holder)
- Optical bench or metre rule
- White screen
- Illuminated object (e.g., crossed wires or lamp)
- Meter rule

Carry out an investigation to determine the focal length of the convex lens using the object-image distance method.

In your report, include the following:

1. Aim of the investigation.
2. Variables: Independent, dependent, and controlled.
3. Hypothesis.
4. Apparatus and materials used.
5. Procedure (step-by-step).
6. Results: Record data in a suitable table (use at least six different object distances u; include calculated values of $1/u$ and $1/v$).
7. Graph: Plot a suitable graph (e.g., $1/v$ against $1/u$) to obtain a linear relationship.

8. Analysis and calculations: Determine the focal length f from the graph and verify the lens formula using at least one set of data.
9. Sources of error and how they can be minimised.
10. Precautions.
11. Conclusion and real-life application related to the scenario.

End of Paper