Mohamed Kheider University of Biskra

Department of Material Sciences

Final Semester Revision

English for Scientific Communication

Semester 4 — Physics Students

Date: 18/04/2026
Duration: 2 hours
Total Points: 20

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STUDENT INFORMATION
Name: _____
Group: _____

GENERAL INSTRUCTIONS

1. Write all answers in the spaces provided.
2. Use **pen** for all written responses. Pencil is acceptable only for diagrams.
3. Read all instructions carefully before beginning each section.
4. Manage your time wisely. Suggested times are indicated for each section.

PART A: READING COMPREHENSION

Suggested time: 30 minutes

Read the following abstract carefully. Then answer questions 1-5.

Thermal Conductivity Enhancement in Nanofluid Systems: A Experimental Study

Abstract: The present investigation examines the thermal conductivity of copper oxide (CuO) nanoparticles suspended in ethylene glycol. Nanofluids have attracted significant attention due to their potential applications in heat transfer systems. Previous studies have demonstrated that the addition of nanoparticles to base fluids can substantially improve thermal properties. However, the mechanisms underlying this enhancement remain incompletely understood. In this experimental study, CuO nanoparticles with mean diameters of 30 nm were dispersed in ethylene glycol at volume fractions ranging from 0.5% to 4.0%. Thermal conductivity was measured using the transient hot-wire method at temperatures between 20°C and 60°C. Results indicate that thermal conductivity increases nonlinearly with nanoparticle concentration, with a maximum enhancement of 22.4% observed at 4.0% volume fraction and 60°C. The observed enhancement exceeds predictions from classical effective medium theories, suggesting that Brownian motion and nanoparticle clustering may contribute significantly to heat transfer mechanisms. These findings have important implications for the design of advanced cooling systems in electronic and automotive applications.

1. What is the **primary objective** of this study?
Select the best answer:

a) To develop a new theory of thermal conductivity

b) To investigate thermal conductivity in CuO-ethylene glycol nanofluids

c) To compare different types of nanoparticles

d) To replace ethylene glycol with water

Answer: _____

2. According to the text, what method was used to measure thermal conductivity?

_____

_____

3. What can be **inferred** about classical effective medium theories based on this study?

_____

_____

4. The word ***substantially*** in line 4 is closest in meaning to:

a) slightly

b) significantly

c) unexpectedly

d) theoretically

Answer: _____

5. The phrase ***this enhancement*** in line 6 refers to:

a) The addition of nanoparticles to base fluids

b) The improvement of thermal properties

c) The use of ethylene glycol as a base fluid

d) The 22.4% increase in thermal conductivity

Answer: _____

PART B: VOCABULARY AND GRAMMAR IN CONTEXT

Suggested time: 20 minutes

6. Word Formation
Complete the sentences with the correct form of the word in parentheses.

a) The _____ (measure) were recorded at 5-minute intervals.

b) The _____ (investigate) revealed significant discrepancies.

c) Thermal _____ (conduct) is essential for heat sink design.

d) The results were _____ (expect), contradicting our hypothesis.

e) The _____ (relate) between temperature and resistance is linear.

7. Collocations
Complete the phrases with the appropriate verb. Choose from: **exert** / **undergo** / **demonstrate** / **observe** / **derive**

a) to _____ a force on an object

b) to _____ thermal expansion

c) to _____ a phenomenon experimentally

d) to _____ a conclusion from data

e) to _____ a phase transition

8. Passive Voice
Rewrite the following sentences in the passive voice. Do not change the tense.

a) We measured the velocity at regular intervals.

_____

b) The research team has published the findings in *Nature*.

_____

c) Scientists will present the results at the conference.

_____

9. Tense Selection
Choose the correct verb form. Circle your answer.

a) Previous studies **(showed / have shown / showing)** that temperature affects conductivity.

b) In 2020, Smith **(demonstrates / demonstrated / has demonstrated)** this phenomenon.

c) The experiment **(is conducted / was conducted / conducted)** last week.

d) We **(observe / observed / have observed**) similar behavior in other materials.

e) The theory **(predicts / predicted / is predicting**) the outcome accurately.

PART C: SUMMARY WRITING

Suggested time: 40 minutes

Task: Read the following text and write a summary of **100-120 words**.

Requirements:

- Include: research objective, method, main result, and conclusion
- Use your own words (do not copy phrases directly from the text)
- Write between 100 and 120 words (count will be verified)

- Write clearly and concisely

Original Text: Graphene-Based Supercapacitors for Energy Storage

The increasing demand for renewable energy sources has intensified research into efficient energy storage systems. Conventional batteries, while widely used, suffer from limited charging rates and reduced lifespan after repeated cycles. Supercapacitors represent an alternative technology capable of rapid charging and discharging with minimal degradation. However, traditional supercapacitors using activated carbon electrodes exhibit relatively low energy density compared to batteries.

Recent investigations have focused on graphene, a two-dimensional carbon material with exceptional electrical conductivity and surface area, as an electrode material for supercapacitors. A research team at the Technical University of Munich recently developed a novel graphene aerogel electrode structure that significantly increases surface area while maintaining structural integrity. The researchers fabricated these electrodes using a hydrothermal synthesis method followed by freeze-drying. Electrochemical testing revealed that supercapacitors with these electrodes achieved an energy density of 88 Wh/kg, nearly double that of conventional supercapacitors and approaching the range of lithium-ion batteries. Furthermore, the devices maintained 95% of their capacity after 10,000 charge cycles.

The team suggests that these graphene-based supercapacitors could bridge the gap between conventional supercapacitors and batteries, offering applications in electric vehicles, grid storage, and portable electronics where rapid charging is essential. Future work will focus on scaling up production and integrating these devices into commercial systems.

Your Summary (100-120 words):

Word count: _____ words (self-reported)

PART D: SHORT ESSAY / ABSTRACT WRITING

Suggested time: 30 minutes

Task: Choose **ONE** of the following topics. Write a coherent text of **150 words** (±20 words).

Option A: Research Abstract
You have conducted an experiment investigating how temperature affects the electrical resistance of a metal wire. Write an abstract for a scientific journal. Include: background/context, objective, brief description of method, expected or hypothetical results, and significance.

Option B: Science Communication
Explain the concept of **entropy** to a non-scientific audience (e.g., a high school student or family member). Your explanation should include a definition, an everyday example, and why this concept matters.

Option C: Process Description
Describe the experimental procedure for measuring the speed of sound in air using a resonance tube. Write for a laboratory manual. Include: materials needed, step-by-step procedure, and one safety precaution.

Your choice: Circle A, B, or C **A** **B** **C**

Your Text (150 words):

Word count: _____ words (self-reported)

END OF REVISION

Dr: OUAAR Fatima.

Good luck!