
Mohamed Kheider University of Biskra

Department of Material Sciences

Final Semester Revision — ANSWER KEY

English for Scientific Communication

Semester 4 — Physics Students

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Total Points: 20

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ANSWER KEY

PART A: READING COMPREHENSION

1. What is the **primary objective** of this study?

Select the best answer:

- a) To develop a new theory of thermal conductivity
- b) **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: **b)**

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

The transient hot-wire method.

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

Classical effective medium theories underpredict / underestimate the observed thermal conductivity enhancement. They are insufficient to fully explain the heat transfer mechanisms; Brownian motion and nanoparticle clustering appear to play significant roles beyond classical predictions.

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

- a) slightly
- b) **b) significantly**
- c) unexpectedly

d) theoretically

Answer: **b)**

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

- a) The addition of nanoparticles to base fluids
- b) **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: **b)**

PARTB: VOCABULARY AND GRAMMAR IN CONTEXT

6. Word Formation

Complete the sentences with the correct form of the word in parentheses.

- a) The **measurements** (measure) were recorded at 5-minute intervals.
- b) The **investigation** (investigate) revealed significant discrepancies.
- c) Thermal **conductivity** (conduct) is essential for heat sink design.
- d) The results were **unexpected** (expect), contradicting our hypothesis.
- e) The **relationship** (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 **exert** a force on an object
 - b) to **undergo** thermal expansion
 - c) to **observe** a phenomenon experimentally
 - d) to **derive** a conclusion from data
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- e) to **undergo** 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.

The velocity was measured at regular intervals.

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

The findings have been published in *Nature*.

- c) Scientists will present the results at the conference.

The results will be presented at the conference.

9. Tense Selection

Choose the correct verb form. Circle your answer.

- a) Previous studies **have shown** (showed / have shown / showing) that temperature affects conductivity.
- b) In 2020, Smith **demonstrated** (demonstrates / demonstrated / has demonstrated) this phenomenon.
- c) The experiment **was conducted** (is conducted / was conducted / conducted) last week.
- d) We **have observed** (observe / observed / have observed) similar behavior in other materials.
- e) The theory **predicts** (predicts / predicted / is predicting) the outcome accurately.

PART C: SUMMARY WRITING — Model Answer (108 words)

Researchers are developing graphene-based supercapacitors to address the limitations of conventional batteries and existing supercapacitors. A team at the Technical University of Munich created novel graphene aerogel electrodes using hydrothermal synthesis followed by freeze-drying. Electrochemical tests showed these supercapacitors achieved an energy density of 88 Wh/kg, almost

twice that of conventional devices and comparable to lithium-ion batteries. Additionally, the devices retained 95% of their capacity after 10,000 charge cycles. The researchers conclude that this technology could bridge the gap between traditional supercapacitors and batteries. Potential applications include electric vehicles, grid storage, and portable electronics requiring rapid charging. Future research will focus on scaling up production and commercial integration.

PART D: SHORT ESSAY / ABSTRACT WRITING — Model Answers

Option A: Research Abstract (115 words)

This study investigates the effect of temperature on the electrical resistance of metal wires. While the relationship between temperature and resistance is well-established for many conductive materials, precise experimental verification remains essential for practical engineering applications. We systematically measured the resistance of a copper wire at temperatures ranging from 20°C to 100°C using a four-point probe method and a controlled heating chamber. Our results indicate that resistance increases linearly with temperature, closely following the expected theoretical model. The temperature coefficient of resistance was experimentally determined to be approximately 0.0039 per degree Celsius. These findings confirm standard theoretical predictions and provide reliable practical data for designing temperature-sensitive electrical components and thermal sensors in various industrial and electronic systems.

Option B: Science Communication — Entropy (113 words)

Entropy is a scientific concept that describes the natural tendency of systems to become more disordered over time. Imagine a tidy bedroom: if you do not actively clean it, clothes and books gradually scatter everywhere. This movement from order to disorder reflects increasing entropy. In physics, entropy measures how spread out energy becomes within a system. The second law of thermodynamics states that total entropy in any isolated system always increases. This principle explains why ice melts in warm water, why smoke disperses in air, and why buildings decay without maintenance. Understanding entropy matters because it governs the efficiency of engines, the direction of chemical reactions, and even the long-term fate of the universe. It tells us that maintaining order requires constant energy input.

Option C: Process Description — Speed of Sound (122 words)

Materials: A resonance tube with water reservoir, tuning fork of known frequency, rubber mallet, thermometer, and meter stick. **Procedure:** Fill the tube partially with water and adjust the level using the reservoir. Strike the tuning fork with the mallet and hold it above the tube opening. Slowly lower the water level until you hear the loudest resonance sound, indicating maxi-

mum amplitude. Record the air column length from the water surface to the tube top. Repeat for the next resonant position. Measure room temperature to calculate sound speed using $v = f\lambda$, where $\lambda = 4L$ for the first resonance. Average results from multiple trials. Safety precaution: Always strike the tuning fork gently away from the glass tube to prevent breakage and potential injury from flying fragments.

END OF ANSWER KEY

Dr: OUAAR Fatima.