

TSS NATIONAL EXAMINATIONS, LEVEL 5, 2025-2026

**TRADES: AUT, WIR, FOR, WOT, MAT, ETE, ELT, REN,
BDC, PWO, LSV, PLT, IND, CSA, NIT, SWD**

SUBJECT: APPLIED PHYSICS B

DURATION: 3 HOURS

INSTRUCTIONS TO CANDIDATES:

1. This Exam paper is composed of **three sections (A, B and C)**. Follow the instructions given below and answer the indicated questions for a total of **100 marks**.

Section **A**: Fifteen (15) questions which are **Compulsory** **55 marks**

Section **B**: Among the five (5) questions, attempt any three (3) **30 marks**

Section **C**: One (1) compulsory question **15 marks**

2. Fill in your actual **Names** and **Index number** on the provided space(Cover).
3. Do not remove or tear any page or part of it of this Questions and Answers Booklet.
4. Answer in the language in which the Examination is set.
5. In section **A, B** and **C**, answer questions in the provided space. In case of multiple choice questions, just **circle** the letter corresponding to the correct option.

6. **Allowed materials**

- **Blue** pen
- Mathematical set
- Non-programmable calculators

Note: The use of Black Pen/Green Pen/Red Pen, and Pencils is strictly prohibited, except when recommended.

SECTION A: ATTEMPT ALL QUESTIONS**(55 Marks)**

1) Select and circle the letter corresponding to the correct answer from the given alternatives.

(4 marks)

- I) Which of the following devices cannot measure distance?
- A) Vernier Calipers
 - B) Micrometer
 - C) Ruler
 - D) Protractor
- II) In a measurement, it is found that the experimental value is very close to actual, hence the experimental value is:
- A) Accurate
 - B) Precise
 - C) Suitable
 - D) Both accurate and precise
- III) How are systematic errors removed usually for an instrument?
- A) By replacing it
 - B) By re-calibrating it
 - C) By using a repairing service
 - D) By taking many measurements and taking the average
- IV) $[MLT^{-2}]$ matches with the dimensional formula of:
- A) Force
 - B) Modulus of elasticity
 - C) Displacement
 - D) Strain

2) State whether each of the following statements is **True** or **False**. **(4 marks)**

- A) Displacement is always equal to the total distance travelled by an object.....
- B) The slope of a position time graph represents the acceleration of the object.....
- C) The area under the velocity time graph represents the displacement of the object.....

D) In the equation $s = v_0t + \frac{1}{2}at^2$, the term $\frac{1}{2}at^2$ represents displacement due to initial velocity.....

3) Match the items in column A with their correct descriptions in column B.

write the correct number letter pair (e.g., V)-F))

(4 marks)

Column A	Column B
I) Electrostatic repulsion	A) Two balloons, both rubbed with wool, hanging near each other.
II) Electrostatic induction	B) Two oppositely charged rods brought close together
III) Charge distribution	C) Charge rearrange on conductor when a charged object is brought closer without touching
IV) Electrostatic attraction	D) Electric charges spread over the surface of a conductor

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4) Choose the option that best answers the question or completes the statement.

(4 marks)

I) Bending of light when it passes from one medium to another is known as:

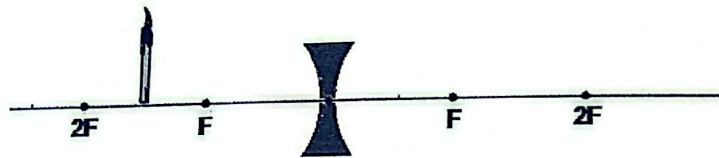
- A) Reflection
- B) Refraction
- C) Dispersion
- D) Total internal reflection

II) When an object is placed in front of a plane mirror, the image is?

- A) Upright, magnified and real
- B) Upright, the same size and virtual
- C) Inverted demagnified and real
- D) Inverted magnified and virtual

III) An object is placed in front of a diverging lens at a distance between F and $2F$. the image produced by the lens is:

- A) Real inverted and demagnified
- B) Real inverted and magnified
- C) Virtual, upright and magnified
- D) Virtual, upright and demagnified.



IV) The rear view mirrors of a vehicle should produce:

- A) Inverted and diminished image
- B) Enlarged and inverted image
- C) Enlarged and erect image
- D) Diminished, virtual and erect image

5) Fill in the blank space with the right energy source from the list below.

Two distractor sources are included in the list.

(3 marks)

Fossil fuel, Nuclear energy, Wind energy, Solar energy, Biomass energy, Hydroelectric energy.

- I)is produced by splitting atoms. There is a risk of accident and this form of energy produces dangerous wastes.
- II) takes energy from flowing water such as rivers, streams and ocean current.
- III)produces energy by moving blades on a turbine or mills. It is clean energy but it can make a lot of noise.

6) Read carefully the statements below and state whether they are **True (T)** or **False (F)**.

(3marks)

- I) According to Kepler's second law, a line joining a planet to the Sun sweeps out equal areas in equal intervals of time.....

II) The universal gravitational constant G depends on the masses of the objects involved and distance between them.....

III) All celestial objects move with constant speed throughout their orbits around the Sun.....

7) Fill in the blank space with the correct term from the suggested word bank. Four distractors are included **(3 marks)**

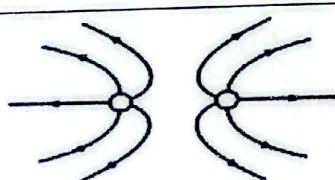
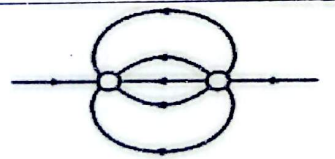
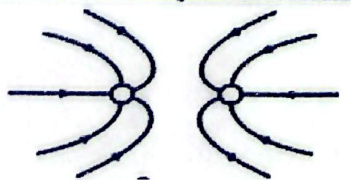
Climate change, greenhouse effect, climate feedback, climate lag, climate model, volcanic eruption.

A. Theoccurs when certain gases in the atmosphere trap heat and warm the Earth's atmosphere.

B. Natural phenomena such ascan influence global temperatures by releasing gases in particles in the atmosphere.

C. Processes that either amplify or reduce the effect of climate changes are known as

8) Match the field diagrams in column A with their descriptions in Column B. **(3 marks)**

Column A	Column B
I) 	A) two positive charges
II) 	B) two negative charges?
III) 	C) two opposite charges?

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9) Choose the option that best answers the question or completes the statement.

(4 marks)

I) If a body's net external force is zero, it has:

- A) Zero velocity
- B) Zero acceleration
- C) Non-zero acceleration
- D) Constantly increasing velocity

II) For a body moving on a rough horizontal surface, friction acts:

- A) In the direction of motion
- B) Opposite to the motion.
- C) Vertically upward
- D) Normal to the surface.

III) Rocket propulsion is best explained by:

- A) Newton's first law
- B) Newton's second law
- C) Newton's third law
- D) Law of gravitation.

IV) A free body diagram of an ascending rocket must include:

- A) Only thrust force
- B) Thrust and weight only
- C) Thrust, air resistance and weight
- D) Only upward forces

10) Choose the option that best answers the question.

I) A voltmeter is connected in a circuit:

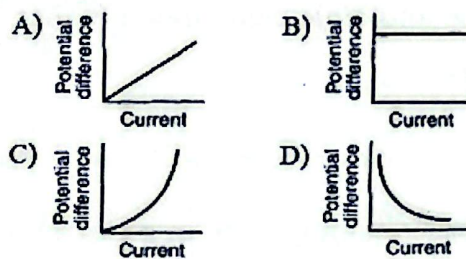
(4 marks)

- A) In series with the resistor
- B) In parallel across the component
- C) Before the battery
- D) Anywhere randomly

II) In parallel combination of resistors, the voltage across each resistor is:

- A) Different
- B) The same
- C) Zero

- D) Proportional to the resistance
- III) The electromotive force of a cell represents
- A) The resistance inside a cell
 - B) Energy supplied per unit charge
 - C) Current in the circuit
 - D) Power loss
- IV) Which graph best represents the relationship between potential difference across a metallic conductor and the resulting current through the conduct at a constant temperature?



- 11) Indicate whether each of the following statements is **True (T)** or **False (F)**.
 (4marks)

- A) As the distance of the planet from the sun increases, the period of revolution decreases.....
- B) The line joining the planet and the sun sweeps equal areas in equal intervals of time.....
- C) The square of the mean distance of a planet from the sun is proportional to the cube of its orbital period.....
- D) Every planetary orbit is an ellipse with the sun at one focus.....

- 12) Read carefully the questions and choose the option that best answers each of them.
 (4 marks)

- I) The length of a wire is increased by 20% by applying a stress of magnitude $4.0 \times 10^{10} \text{ N/m}^2$. The Young's modulus of the wire material is:
- A) $1.0 \times 10^{11} \text{ N/m}^2$
 - B) $2.0 \times 10^{11} \text{ N/m}^2$
 - C) $1.0 \times 10^{10} \text{ N/m}^2$
 - D) $2.0 \times 10^{10} \text{ N/m}^2$

II) Two planets orbit the Sun in circular motion with their radius as $R_1=R$ and $R_2=4R$. the ratio of their periods (T_1/T_2) around the Sun will be:

- A) $1/16$
- B) $1/8$
- C) $1/4$
- D) $1/2$

13) Choose the option that best answers the question from proposed alternatives.

(3 marks)

I) According to Carnot's theorem, all heat engines operating between a given constant temperature source and sink, none has a higher efficiency than a reversible engine.

- A) True
- B) False

II) The correct sequence of the processes taking place in a Carnot cycle is:

- A) Adiabatic, adiabatic, isothermal, isothermal.
- B) Adiabatic, isothermal, adiabatic, isothermal.
- C) Isothermal, adiabatic, isothermal, adiabatic
- D) Isothermal, isothermal, adiabatic, adiabatic

III) An ideal gas heat engine operates in Carnot's cycle between 227°C and 127°C . it absorbs $6 \times 10^4 \text{J}$ at high temperature. The amount of heat converted into work is:

- A) $4.8 \times 10^4 \text{J}$
- B) $3.5 \times 10^4 \text{J}$
- C) $1.6 \times 10^4 \text{J}$
- D) $1.2 \times 10^4 \text{J}$

14) The magnification of a compound microscope is 20. The focal length of the eyepiece is 5 cm and the image is formed at near point (25cm).

(5 marks)

I) Fill in the blank space with the correct term to complete the statement.

- A) In a compound microscope, thelens forms a real image, inverted and magnified of the object.
- B) The final image seen by the eye is produced by the..... lens, which magnifies the intermediate image.
- C) To increase magnification while keeping the image clear, the object must be placed beyond the of the objective lens.

II) The magnification of the objective lens for the above microscope is:

- A) 5.6
- B) 6.78
- C) 3.33
- D) 4.1

- 15) A 50 g mass vibrates in simple harmonic motion at the end of a spring. The amplitude of the motion is $A=12$ cm and the period is $T=0.1$ minutes.

(3 marks)

I) Calculate the angular frequency of the oscillating mass.

- A) π rad/s
- B) 2π rad/s
- C) $\pi/3$ rad/s
- D) $\pi/2$ rad/s

II) What will be the speed of the mass at $x = \frac{A}{2}$?

- A) 0.11m/s
- B) 0.21 m/s
- C) 0.35m/s
- D) 0.40m/s

III) At what instants is the mass's energy pure kinetic?

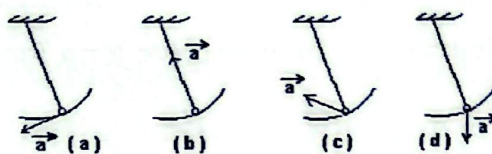
- A) When $x=A$
- B) When $x=A/2$
- C) When $x=0$
- D) It cannot happen

SECTION B: ATTEMPT ONLY THREE (3) QUESTIONS (30Marks)

16) Read carefully the questions and answer them by selecting the right option.

- I) A simple pendulum is oscillating without damping. When the displacement of the bob is less than maximum, its acceleration vector $\vec{a}$ is correctly shown in:

(2 marks)



- II) In the case of damped oscillations, which of the following statements is NOT true?

(2 marks)

- A) Amplitude decreases
- B) Periodic time increases
- C) Energy of oscillator decreases
- D) Amplitude never becomes zero

- III) In the case of forced oscillations, which of the following statements is NOT true?

(2 marks)

- A) Frequency equals that of external periodic force
- B) Amplitude depends upon the damping coefficient
- C) Amplitude tends to infinity at resonance
- D) Higher the damping coefficient, lower is the amplitude at resonance

- IV) What is resonance in the context of oscillating systems?

(2 marks)

- A) When damping force equals restoring force.
- B) When the system oscillates without energy loss.
- C) When the driving frequency matches the natural frequency
- D) When the driving force is zero

- V) When damping is very strong, the system returns to the equilibrium without oscillating. This is called:

(2 marks)

- A) Underdamping
- B) Overdamping
- C) Resonance
- D) Forced oscillation

(2 marks)

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(2 marks)

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18) The diameters of a small piston and a large piston of a hydraulic jack are 3 cm and 10 cm respectively. A force of 80 N is applied on the small piston.

I) State whether the following statements are either **True (T)** or **False (F)**.

(2 marks)

A) A hydraulic press works based on Pascal's principle, which states that pressure applied to a confined fluid is transmitted equally in all directions.....

B) In a hydraulic press, the pressure on the larger piston is greater than the pressure on the smaller piston... ..

II) Find the load lifted by the large piston when:

A) The pistons are at the same level.

(4 marks)

B) Small piston in 40 cm above the large piston.

(4 marks)

19) Read the following questions and answer them correctly.

I) Choose the option that best answers the question **(2 marks)**

A) A person finds that in order to read a book easily she must hold it at arm's length. Which of the following correctly identifies the eye defect, its possible cause and the methods of correction?

- i. Myopia – eyeball too long – corrected using a concave lens.
- ii. Hypermetropia – eyeball too short or weak eye lens – corrected using a convex lens.
- iii. Astigmatism – irregular cornea – corrected using a cylindrical lens.
- iv. Presbyopia – excessive curvature of lens – corrected using a concave lens.

B) Total internal reflection occurs when:

- i. Light passes from a rarer medium to a denser medium.
- ii. Light travelling from a denser medium to a rarer medium.
- iii. Light is partially reflected and partially refracted at any boundary between two media.
- iv. Light strikes a surface at normal incidence and continues without deviation.

II) Light of wavelength 589nm in vacuum passes through a piece of fused quartz whose index of refraction $n=1.458$

A) Find the speed of light in quartz **(2 marks)**

B) What is the wave length of light in quartz? **(3 marks)**

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- III) Find the critical angle for water – air boundary if the index of refraction of water is 1.33. **(3 marks)**

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- 20) Read carefully the following questions and answer them correctly using terms from the box below.

Climate model, renewable, reforestation, volcanic, ocean, intensity

- I) In developing a prediction system, scientists use a computer based..... to simulate how Earth's climate may change under different greenhouse gas emission scenarios. **(2 marks)**
- II) A student designing a campaign to limit global warming suggests replacing the burning of fossil fuels with energy sources such as solar or wind power. **(2 marks)**
- III) To reduce greenhouse gas emissions caused by deforestation, a government proposes a national programme ofand sustainable forest management. **(2 marks)**
- IV) While developing a climate model, students include natural causes of global warming such as eruptions and changes in currents. **(2 marks)**
- V) In developing a model of Earth's energy balance, learners represent the amount of solar energy received per unit area as theof the Sun's radiation. **(2 marks)**

SECTION C: ONE (1) COMPULSORY QUESTION (15Marks)

21) Different energy sources are used to generate electricity in Rwanda.

- I) Use words from the box to match the correct energy source to each of the description given in the table.

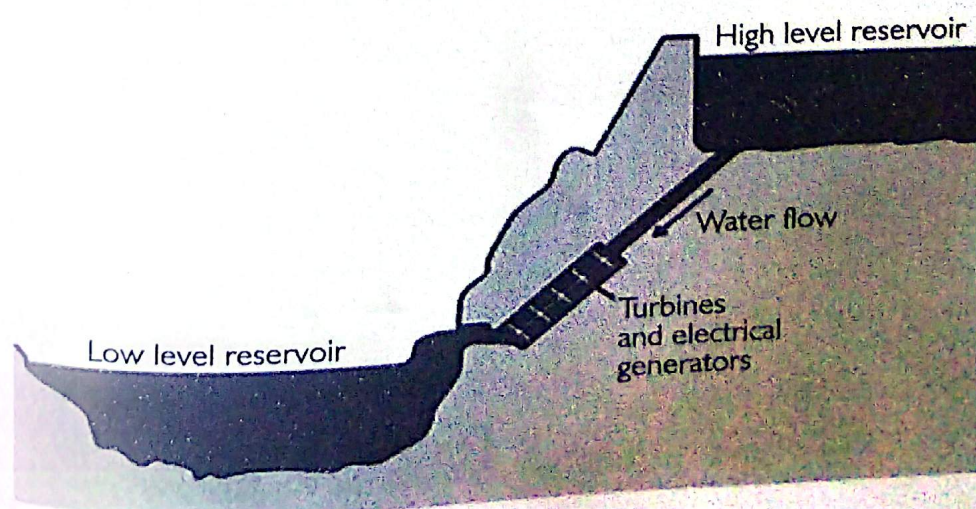
(5 marks)

Solar, wind, hydroelectric, biomass, coal, natural gas, geothermal, nuclear.

Description	Energy source
Energy from the Earth's core is used to heat water.	
Fission of Uranium nuclei is used to heat liquid in nuclear reactor.	
Gases from rotting plants materials are burned to produce heat.	
Organic materials such plants, wood and animal waste are used to produce energy.	
Flowing or falling of water from a dam are used to produce electricity.	

- II) Energy can be stored in pumped storage power station. The figure shows a pumped storage power station.

(3 marks)



Use the correct answer from the box to complete each sentence.

Kinetic, Electrical, gravitational potential, nuclear, sound

The water in the high level reservoir stores.....energy.

The flowing of water hasenergy.

The water turns the turbine which is connected to a generator.

The generator produces some, which is wasted energy.

III) The total power input to a pumped storage is 600MW. The useful power output is 540MW.

A) Calculate the efficiency of this pumped storage power station.

(3 marks)

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B) Calculate how much power is wasted by the pumped storage power station.

(2 marks)

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C) How is the temperature of the surroundings affected by the energy wasted by the pumped storage power station?

(2 marks)

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END OF THE EXAM

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