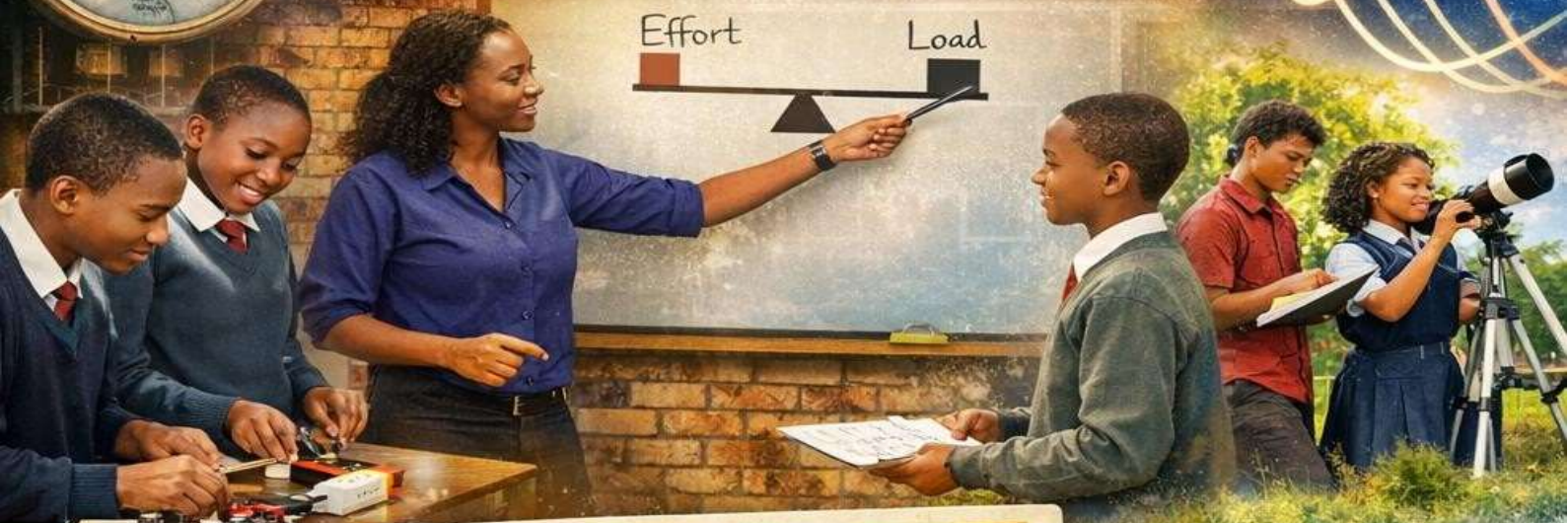
COMPETENCE BASED EDUCATION

SENIOR SCHOOL

GRADE 10 PHYSICS

TOPICAL REVISION BOOK



CONTENTS

1. Mechanics and Thermal Physics
- 1.1 Introduction to Physics
- 1.2 Pressure
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- 1.4 Temperature and Thermal Expansion
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B-STRAND: 1.1 INTRODUCTIONS TO PHYSICS

1. a) Define Physics as a body of knowledge in science. (2 marks)

_____

_____

b) Explain why Physics is considered a science. (2 marks)

_____

_____

2. a) List any four branches of Physics. (2 marks)

i. _____
ii. _____
iii. _____
iv. _____
v. b) For each branch listed, give one practical application. (4 marks)

Branch	Practical application

3. a) Outline three ways in which Physics is important in day-to-day life. (3 marks)

i. _____
ii. _____
iii. _____

b) Explain with an example how Physics improves technology. (3 marks)

i. _____
ii. _____
iii. _____

2. a) Describe two relationships between Physics and Chemistry. (3 marks)

i. _____
ii. _____

b) Give one example where Physics and Chemistry work together in industry. (2 marks)

_____

_____

_____

3. a) Identify two career opportunities in Physics. (2 marks)

i. _____
ii. _____

b) Describe one responsibility of a physicist in each career mentioned. (4 marks)

Career related to physics	Responsibility

4. a) Explain the difference between classical Physics and modern Physics. (4 marks)

Classical physics	Modern physics

b) Give one example of each type in real-life applications. (2 marks)

Example of Classical physics	Example of Modern physics

5. a) Mention two fields of study closely related to Physics. (2 marks)

i. _____
ii. _____

b) Explain briefly how Physics contributes to each field. (3 marks)

i. _____
ii. _____
iii. _____

6. a) Outline two ways in which Physics helps solve environmental problems. (2 marks)

i. _____
ii. _____

b) Explain how one of these methods is applied in energy conservation. (2 marks)

i. _____
ii. _____

7. a) Explain how Physics is applied in astronomy. (2 marks)

i. _____
ii. _____

b) Give two examples of a medical device that uses Physics principles. (2 marks)

i. _____
ii. _____

8. a) Define Mechanics as a branch of Physics. (2 marks)

_____
_____

b) Name two sub-branches of Mechanics and explain their importance. (4 marks)

Branch of mechanics	Importance

9. a) Explain the role of Thermodynamics in daily life. (1 mark)

_____

_____

b) Give one industrial application of Thermodynamics. (1 mark)

i. _____
ii. _____
iii. _____

c) Match the branches of Physics in Column A with their correct descriptions in Column B.

Column A: Branch of Physics	**Column B: Description**
1. Mechanics	A. Study of heat, temperature, and energy transfer
2. Optics	B. Study of motion, forces, and effects of forces on bodies
3. Thermodynamics	C. Study of sound and how it is produced and transmitted
4. Electricity	D. Study of magnets and magnetic fields
5. Magnetism	E. Study of light, vision, lenses, and mirrors
6. Acoustics	F. Study of electric charges, circuits, and current

10. a) Describe the relationship of Physics with other sciences. (3 marks)

i. Physics and Biology

_____

_____

ii. Physics and Computer Science

_____

_____

iii. Physics and Electrical Technology

_____

_____

b) Explain one connection between Physics and Geology. (2 marks)

_____

_____

11. a) Identify three branches of Physics that deal with motion and forces. (3 marks)

i. _____
ii. _____
iii. _____

b) Give one real-life example for each branch listed. (3 marks)

i. _____
ii. _____
iii. _____

12. a) Outline five ways in which Physics affects transportation systems. (5 marks)

i. _____
ii. _____
iii. _____
iv. _____
v. _____

13. a) A student wants to pursue a career in Physics. Suggest three steps they can take to explore career opportunities. (3 marks)

i. _____
ii. _____
iii. _____

b) Explain how these steps will help the student make informed decisions. (2 marks)

i. _____
ii. _____
iii. _____

14. a) Explain two differences between Physics and Biology. (4 marks)

PHYSICS	BIOLOGY

b) Give one factor to consider when choosing a career pathway. (2 marks)

_____
_____

15. a) Explain the importance of studying Physics to a Grade 10 learner. (3 marks)

i. _____
ii. _____
iii. _____

b) Suggest two types of non-print media that can be used to search on information on careers in physics. (2 marks)

i. _____
ii. _____

16. a) Identify two branches of Physics that involve the study of energy. (2 marks)

i. _____
ii. _____

b) Below are descriptions of certain branches of Physics. **Identify the correct branch of Physics** described in each statement. (3 marks)

a) Study of motion, forces and the effects of forces on bodies. _____(1 mark)

b) Study of heat, temperature and how heat energy is transferred. _____(1 mark)

c) Study of light, lenses, mirrors and formation of images. _____(1 mark)

d) Study of electric charges, current, circuits and electrical energy. _____(1 mark)

e) Study of magnets, magnetic fields and magnetic effects. _____(1 mark)

f) Study of sound, vibrations and transmission of sound waves. _____(1 mark)

g) Study of atomic structure, electrons and behaviour of atoms. _____(1 mark)

h) Study of the nucleus of an atom, radioactivity and nuclear reactions. _____(1 mark)

17. a) Define Geometrical Optics as a branch of Physics. (2 marks)

_____

_____

_____

b) Give one application of Geometrical Optics in daily life. (1 mark)

_____

_____

18. a) State three areas where Waves technology is applied. (3 marks)

i. _____
ii. _____
iii. _____

b) Give one example of a wave. (1 mark)

_____

_____

19. a) Give two careers in Electronics. (2 marks)

i. _____
ii. _____

b) Explain two contributions of Electronics to modern technology. (2 marks)

i. _____
ii. _____

20. a) Mention two equipments used in the study of astronomy. (2 marks)

i. _____
ii. _____

b) Explain one way in which Astronomy has improved navigation. (2 marks)

_____

_____

21. Below are descriptions of certain types of energy. **Name the type of energy** described in each statement. (3 marks)

a) Energy possessed by an object due to its motion. _____(1 mark)

b) Energy stored in an object due to its position or height above the ground. _____(1 mark)

c) Energy stored in food, fuels, and batteries. _____(1 mark)

d) Energy produced when an electric current flows through a conductor. _____(1 mark)

e) Energy produced by vibrating objects and transmitted through a medium. _____(1 mark)

f) Energy from the sun that reaches the earth in the form of heat and light. _____(1 mark)

g) Energy stored in a stretched spring or stretched rubber band. _____(1 mark)

h) Energy released during splitting or joining of atomic nuclei. _____(1 mark)

i) Energy produced by burning fuels such as charcoal, wood, or gas. _____(1 mark)

j) Energy carried by light waves. _____(1 mark)

b) Give two examples of a renewable energy technology that uses Physics principles. (2 marks)

i. _____

ii. _____

22. a) Describe the relationship between Physics and Engineering. (3 marks)

_____

_____

_____

b) Give one example of a device that was developed using both Physics and Engineering principles. (2 marks)

_____

_____

23. a) Explain how Physics contributes to communication technology. (3 marks)

i. _____

ii. _____

iii. _____

b) Give one example of a communication device that relies on Physics. (2 marks)

_____

_____

24. a) Outline three ways in which Physics improves safety in transportation. (3 marks)

i. _____

ii. _____

iii. _____

b) Explain one method in detail. (2 marks)

25. a) Define Thermodynamics. (2 marks)

b) Explain one daily life example of Thermodynamics. (2 marks)

26. a) Explain how Physics principles are used in sports. (3 marks)

i.
ii.
iii.

b) Give one example of a sport where Physics is applied. (2 marks)

i.
ii.

27. a) Identify two career paths in Physics related to space science. (2 marks)

i.
ii.

b) Explain one responsibility of professionals in each career path. (3 marks)

28. A factory wants to reduce energy loss and improve efficiency.
a) Suggest one branch of Physics that can help solve this problem. (2 marks)

b) Explain briefly how it can be applied. (3 marks)

i.
ii.
iii.
iv.

c) Mention one possible career for a professional who can help the factory. (2 marks)

d) Outline advantages of using Physics. (3 marks)

i. _____

ii. _____

iii. _____

SUB-STRAND: 1.2 PRESSURE

1. Define atmospheric pressure as used in Physics. (3 marks)

2. State one factor that affects pressure in liquids. (2 marks)

3. Write down the formula for pressure in fluids. (2 marks)

4. Identify one example of the application of atmospheric pressure in daily life. (2 marks)

5. Mention one device that demonstrates the transmission of pressure in fluids. (2 marks)

6. List two examples of hydraulic machines. (2 marks)

7. Define a syphon. (3 marks)

8. State the unit of pressure in the SI system. (2 marks)

9. Explain how the existence of atmospheric pressure can be demonstrated using a simple experiment. (4 marks)

10. a) Describe two effects of atmospheric pressure in nature. (3 marks)

b) Give one example of each effect. (2 marks)

11. a) Explain the factors affecting pressure in liquids. (4 marks)

b) Illustrate your answer with a labeled diagram. (2 marks)

12. A liquid has a density of 1000 kg/m^3 and a depth of 0.5 m. Calculate the pressure exerted at this depth. (Take $g = 10\ m/s^2$) (4 marks)

13. Explain how the equation $P = \rho gh$ is used to determine pressure in fluids. (3 marks)

14. A student wants to investigate the transmission of pressure in fluids. Outline the steps of the experiment they can carry out. (4 marks)

15. Describe how a bicycle pump uses the principle of pressure in fluids. (3 marks)

16. Explain how a syringe works using the concept of pressure transmission. (3 marks)

17. Draw a labeled diagram showing the working of a hydraulic lift and explain the transmission of pressure in it. (5 marks)

18. Explain how a drinking straw works using the concept of atmospheric pressure. (3 marks)

19. a) Describe the mechanism of water pumping using atmospheric pressure. (3 marks)

b) Give one example of its application in daily life. (2 marks)

20. Explain how pressure varies with depth in a liquid and relate this to fluid density. (3 marks)

21. A liquid column has a height of 2 m and a density of 1200 kg/m^3. Calculate the pressure at the base of the column. (Take $g = 10\ m/s^2$) (4 marks)

22. Explain the role of atmospheric pressure in maintaining the flow of a syphon. (3 marks)

23. Discuss one factor that can affect the efficiency of a hydraulic machine and suggest a way to overcome it. (3 marks)

24. Describe an experiment that can show the effect of liquid density on pressure. (3 marks)

25. A factory uses a hydraulic press to lift heavy loads.
    a) Explain the principle behind its operation. (3 marks)

    b) Suggest two improvements that can increase the efficiency of the press. (2 marks)

26. A container is filled with two immiscible liquids, one on top of the other.
    a) Explain how pressure is transmitted at the interface of the two liquids. (3 marks)

    b) Calculate the total pressure at a point 1 m below the top surface if 0.6 m is water ($\rho = 1000\ kg/m^3$) and 0.4 m is oil ($\rho = 800\ kg/m^3$). Take $g = 10\ m/s^2$. (4 marks)

27. A syringe is used to lift water.
    a) Explain using pressure transmission why the water rises when the plunger is pulled. (3 marks)

    b) Discuss how changing the diameter of the syringe affects the ease of lifting water. (2 marks)

28. A hydraulic machine has a small piston of area 0.01 m^2 and a large piston of area 0.5 m^2.
    a) If a force of 200 N is applied on the small piston, calculate the force on the large piston. (3 marks)

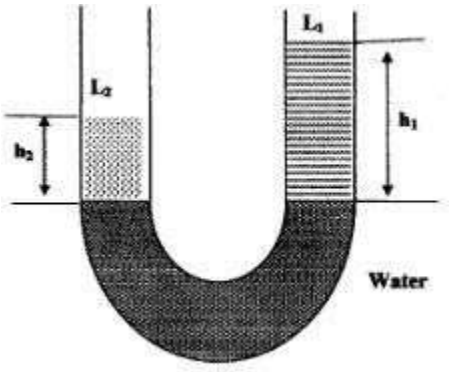
    b) Explain the practical advantage of such a machine. (2 marks)

29. Explain how atmospheric pressure is responsible for the crushing of a metal can when heated and then cooled. (5 marks)

30. A student is designing an experiment to demonstrate the factors affecting pressure in fluids.
    a) Suggest two factors that can be varied. (2 marks)

    b) Explain the expected outcome for each factor. (3 marks)

31. The figure below shows a U – tube containing two liquids L_1 and L_2 of densities 0.5 g/cm³ and 0.8 g/cm³ respectively floating on a water surface. If the system is in equilibrium, determine the ratio h_1: h_2 (3mks)



SUB-STRAND: 1.3 MECHANICAL PROPERTIES OF MATERIALS

1. Define the term **ductility** as a mechanical property of materials. (3 marks)

2. State what is meant by **malleability**. (2 marks)

3. Define **elasticity** in materials. (2 marks)

4. Give one example of a **brittle material**. (2 marks)

5. List two materials that are known for their **hardness**. (2 marks)

6. State the unit of **stress** in the SI system. (2 marks)

7. Write the formula for **strain** in a material under tension. (2 marks)

8. Name one application of **stiffness** in daily life. (2 marks)

9. Explain the difference between **strength** and **stiffness** in materials. (3 marks)

10. a) Describe two mechanical properties of metals that make them suitable for construction. (3 marks)
    b) Give one example for each property. (2 marks)

11. A wire of cross-sectional area 2×10^{-4} m² is subjected to a tensile force of 100 N. Calculate the **stress** in the wire. (Take stress = F/A) (3 marks)

12. A rod of length 2 m is stretched by 2 mm under a tensile force. Calculate the **strain** in the rod. (2 marks)

13. State **Hooke's Law** and explain its significance in determining elasticity. (3 marks)

14. A spring extends by 0.05 m when a force of 10 N is applied. Determine the **constant of elasticity** (spring constant). (3 marks)

15. Explain how **elasticity** is demonstrated in a simple classroom experiment using a rubber band. (3 marks)

16. a) Describe **ductility** and **brittleness** in terms of atomic structure. (3 marks)

b) Give an example of each. (2 marks)

17. Explain how **hardness** is tested using simple tools in a laboratory. (3 marks)

18. A wire of initial length 1.5 m is stretched to 1.503 m under a tensile force. Calculate:
    a) The **strain** (2 marks)

    b) If the stress is 3×10^6 Pa, calculate the **modulus of elasticity Y**. (3 marks)

19. Explain how the **modulus of elasticity** affects the choice of materials for bridges. (3 marks)

20. Describe **industrial applications** of:
    a) Ductility (2 marks)

    b) Malleability (2 marks)

    c) Hardness (2 marks)

21. Explain why **brittle materials** are generally unsuitable for making cables. (3 marks)

22. Describe a classroom activity to demonstrate **stiffness** in different materials. (3 marks)

23. A metal rod has a cross-sectional area of 0.01 m^2 and is subjected to a tensile force of 5000 N. Calculate the **tensile stress**. (3 marks)

24. A steel wire of 2 m length is stretched by 4 mm under a tensile force of 800 N. The cross-sectional area of the wire is 1×10^{-4} m^2.
    a) Calculate the **stress** in the wire. (3 marks)

    b) Calculate the **strain**. (2 marks)

    c) Determine the **modulus of elasticity**. (3 marks)

25. Discuss how the **mechanical properties of materials** influence the design of:
    a) Car bodies (2 marks)

    b) Aircraft wings (3 marks)

26. Compare and contrast **ductile** and **brittle materials** in terms of:
    a) Tensile behavior (2 marks)

    b) Industrial applications (3 marks)

27. A student wants to determine the **modulus of elasticity** of a wire. Suggest a step-by-step experimental procedure. (5 marks)

28. Explain how knowledge of **mechanical properties** helps in:
    a) Construction industry (2 marks)

    b) Manufacturing of tools (3 marks)

29. A spring stretches by 0.02 m under a force of 5 N. Another spring made of a different material stretches by 0.05 m under the same force.
    a) Determine which spring is stiffer. (2 marks)

    b) Explain why the difference occurs. (3 marks)

30. Design a simple experiment to demonstrate **Hooke's Law**, and describe how you would:

a) Measure the extension (2 marks)

b) Determine the spring constant (3 marks)

SUB-STRAND: 1.4 TEMPERATURE AND THERMAL EXPANSION

1. Define **temperature** as used in thermal physics. (3 marks)

2. State the SI unit of temperature. (2 marks)

3. Define **linear expansion** of solids. (2 marks)

4. Give one example of a **liquid expansion device** used to measure temperature. (2 marks)

5. Mention one unusual property of water related to thermal expansion. (2 marks)

6. Name one application of thermal expansion in bridges. (2 marks)

7. Define a **thermocouple**. (3 marks)

8. State one material commonly used to demonstrate linear thermal expansion in metals. (2 marks)

9. a) Explain the difference between **temperature** and **heat**. (3 marks)

   b) Give one example to illustrate the difference. (2 marks)

10. Explain how a **bimetallic strip** can be used to measure temperature. (3 marks)

11. Describe the principle behind the operation of a **thermistor**. (3 marks)

12. Explain how thermal expansion can affect **power lines**. (3 marks)

13. A metal rod of length 2 m has a linear expansivity of 1.2×10^{-5} /°C. Calculate its increase in length when heated by 50°C. (4 marks)

14. Describe an experiment to demonstrate the **thermal expansion of water**. (3 marks)

15. Explain why water is unusual in its expansion when cooled near 4°C. (3 marks)

16. Describe how a **liquid expansion thermometer** works. (3 marks)

17. Explain the importance of thermal expansion in **railway tracks**. (3 marks)

18. Describe the principle of **resistive temperature devices (RTDs)** in measuring temperature. (3 marks)

19. a) A copper wire 1.5 m long is heated from 20°C to 70°C. Its linear expansion coefficient is 1.7×10^{-5} /°C. Calculate the change in length. (3 marks)

b) Explain the practical importance of this calculation. (2 marks)

20. Describe how thermal expansion is applied in a **thermostat** used in electrical devices. (3 marks)

21. Explain how thermal expansion is important in **metal work** and construction. (3 marks)

22. Outline a classroom activity to measure the **linear expansion of metals**. (3 marks)

23. Explain why bridges have expansion gaps. (2 marks)

24. Describe one method to measure temperature using **silicon diodes**. (2 marks)

25. A steel bridge is 100 m long at 20°C. The linear expansion coefficient of steel is 1.2×10^{-5} /°C. Calculate the increase in length if the temperature rises to 40°C. (4 marks)

26. Explain with examples how unusual expansion of water affects **aquatic life** in lakes during winter. (4 marks)

27. A bimetallic strip consists of steel and copper. Explain why it bends when heated and how this property is used in **electrical switches**. (4 marks)

28. The figure 4 below shows a set-up for investigating the thermal expansion of water:

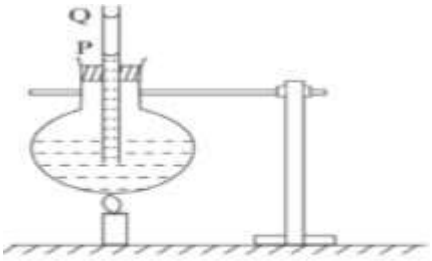


Figure 4

The level of water in the tube initially falls slightly before it rises from P to Q. Explain. (2 marks)

29. Discuss three applications of thermal expansion in **everyday life**, explaining the physics behind each. (5 marks)

30. A copper rod is heated and its length increases by 0.3 cm. If its original length was 1.5 m and the temperature rise was 50°C, calculate the **linear expansion coefficient** of copper. (4 marks)

SUB-STRAND: 1.5 MOMENTS AND EQUILIBRIUM (C.O.G AND STABILITY)

1. Define **moment of a force**. (3 marks)

2. State the **principle of moments**. (3 marks)

3. Define **torque**. (2 marks)

4. Define a **couple** in mechanics. (2 marks)

5. State the **unit of moment** in the SI system. (2 marks)

6. Define **centre of gravity** (C.O.G) of an object. (3 marks)

7. Mention one factor that affects the **stability of a body**. (2 marks)

8. Name one example of an **object in neutral equilibrium**. (2 marks)

9. Explain the difference between **stable, unstable, and neutral equilibrium** with examples. (4 marks)

10. A uniform beam of length 4 m is pivoted at its midpoint. A force of 20 N is applied at one end.
    a) Calculate the moment about the pivot. (3 marks)

b) Explain what happens if the same force is applied at half the length. (2 marks)

11. Explain how the **centre of gravity of a regular object** can be determined experimentally. (3 marks)

12. Describe a method to determine the **centre of gravity of an irregularly shaped lamina**. (3 marks)

13. Explain the turning effect of a force about a point. (3 marks)

14. A uniform meter rule is balanced on a knife edge at 40 cm mark. A 2 N weight is hung at the 10 cm mark.
    a) Calculate the balancing weight to hang at the 90 cm mark to keep it in equilibrium. (4 marks)

15. Explain how a **torque** causes rotation in a door. (3 marks)

16. Describe one **industrial application of a couple**. (3 marks)

17. A lever of length 2 m has a force of 50 N applied perpendicularly at its end. Calculate the **moment** of the force. (3 marks)

18. Explain how **resolution of forces** can help determine the resultant force on a body. (3 marks)

19. Discuss the importance of **centre of gravity** in designing vehicles. (3 marks)

20. Explain the effect of **base area and height** on the stability of a body. (3 marks)

21. Describe a classroom activity to **verify the principle of moments** using a meter rule and weights. (3 marks)

22. Explain how **moment about two points of support** is demonstrated in a see-saw. (3 marks)

23. A uniform rod of weight 20 N and length 1.5 m is pivoted at 0.5 m from one end. Calculate the **moment of the rod about the pivot**. (3 marks)

24. A ladder leans against a wall. Discuss the factors that determine whether it remains in stable equilibrium. (4 marks)

25. A meter rule is pivoted at 40 cm mark. A weight of 5 N is placed at 10 cm mark and a weight of 2 N at 90 cm mark.
    a) Calculate the moment about the pivot. (3 marks)

    b) Determine whether the rule is in equilibrium. (2 marks)

26. A uniform horizontal beam 3 m long is supported at its ends. Two weights, 100 N and 150 N, are placed at 0.5 m and 2 m from one end.
    a) Calculate the reaction at each support. (4 marks)

    b) Explain how the principle of moments is applied here. (2 marks)

27. Explain how **torque and couples** are used in tightening bolts in mechanical work. (4 marks)

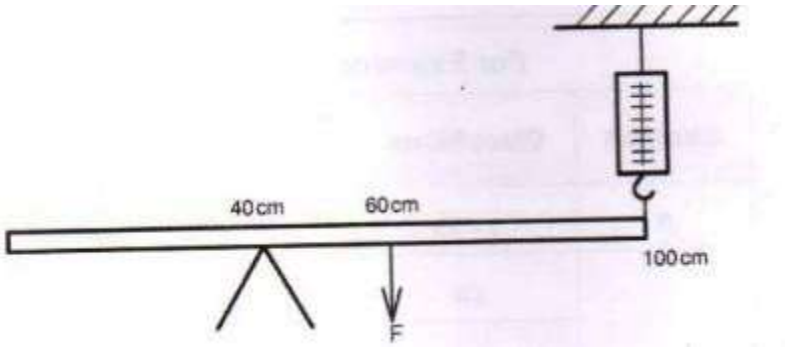
28. Discuss three **applications of moments and stability** in daily life, explaining the physics behind each. (5 marks)

29. Design an experiment to determine the **centre of gravity of an irregular object** suspended from different points. Describe the procedure and expected observations. (5 marks)

30. A uniform rod of length 2 m and weight 50 N is pivoted at its center. A couple of 20 Nm is applied at its ends.
a) Calculate the turning effect of the couple. (3 marks)

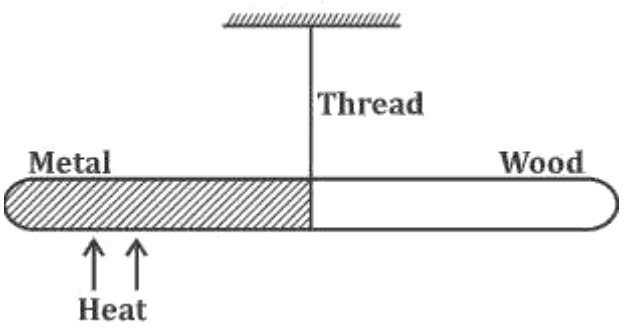
b) Explain the difference between a torque and a couple in this scenario. (2 marks)

31. The figure shows a uniform metre rule of negligible weight pivoted at th 40 cm mark. It is kept at equilibrium by a spring balance attached at the 100 cm mark and force F at the 60 cm mark.



The reaching on the spring balance is 1 N. Determine the value of F. (3 marks)

32. The figure 4.0 shows a rod made of wood on one end and metal on the other end suspended freely with a piece of thread so that it is in equilibrium.



33. The side made of metal is heated with a bunsen burner flame. State with a reason, the side to which the rod is likely to tilt. (2 marks)

_____

_____

34. The Figure below shoes three toy animals hanging from a rod . The rod hangs from the ceiling by a string tied at the centre of the rod. The system is in equilibrium

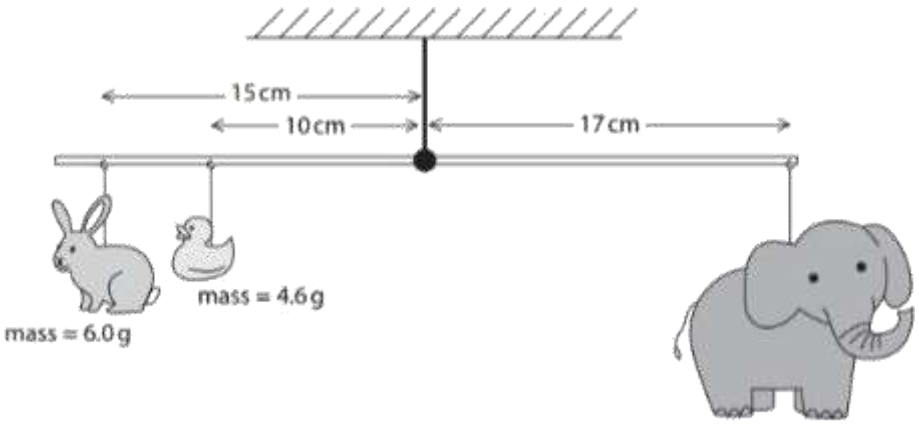


Figure 12

Using principle of moments calculate the weight of the elephant (3mks)

SUB-STRAND: 1.6 ENERGY, WORK, POWER, AND MACHINES

1. Define **energy** as used in physics. (3 marks)

2. State the SI unit of **work**. (2 marks)

3. Define **kinetic energy**. (2 marks)

4. Define **gravitational potential energy**. (2 marks)

5. State the law of **conservation of energy**. (3 marks)

6. Define **power** in physics. (2 marks)

7. Give one example of a **simple machine**. (2 marks)

8. State one application of **machines** in daily life. (2 marks)

9. A ball of mass 0.5 kg is moving with a velocity of 4 m/s. Calculate its **kinetic energy**. (3 marks)

10. A book of mass 2 kg is lifted vertically by 3 m. Calculate its **gravitational potential energy**. (3 marks)

11. A force of 20 N moves an object through a distance of 5 m. Calculate the **work done**. (3 marks)

12. A motor does 200 J of work in 10 s. Calculate the **power output**. (3 marks)

13. Explain the transformation of **gravitational potential energy into kinetic energy** using a swinging pendulum. (3 marks)

14. Describe how **elastic potential energy** is demonstrated using a stretched spring or bow and arrow. (3 marks)

15. Explain how **machines make work easier**, giving one example of a lever. (3 marks)

16. A car engine lifts a load of 500 N through 2 m in 5 s. Calculate the **power** developed. (3 marks)

17. Draw a labeled diagram of a **pulley system** and explain how it reduces effort. (3 marks)

18. Explain the concept of **mechanical advantage** and give one example. (3 marks)

19. A lever has an effort arm of 2 m and a load arm of 0.5 m. Calculate the **mechanical advantage** if the effort is 100 N. (3 marks)

20. Describe the energy transformations in an **elevator system**. (3 marks)

21. Explain the working principle of a **treadmill** using energy transformations. (3 marks)

22. A spring is compressed by 0.1 m. Its spring constant is 200 N/m. Calculate the **elastic potential energy stored**. (3 marks)

23. Explain the difference between **velocity ratio** and **mechanical advantage** in simple machines. (3 marks)

24. A ball of mass 0.2 kg is thrown vertically upward with a speed of 10 m/s.
    a) Calculate its **kinetic energy at launch**. (3 marks)

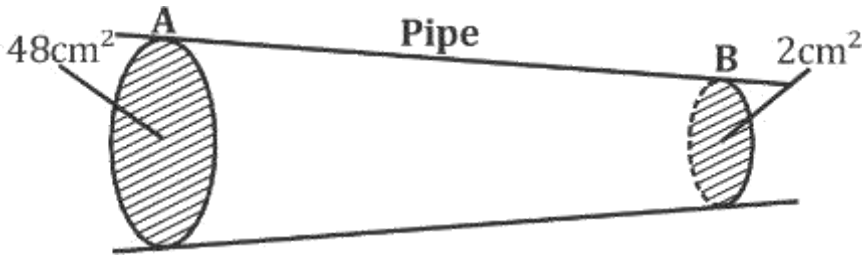
    b) Determine the **maximum height it reaches**. (Take $g = 10\ m/s^2$) (3 marks)

25. Discuss three **applications of pulleys** in construction or daily life, explaining the physics behind each. (5 marks)

26. A hydraulic lift lifts a car of weight 10,000 N. The effort applied on the smaller piston is 500 N.
    a) Determine the **mechanical advantage** of the lift. (3 marks)

    b) Explain the principle that makes the lift work. (2 marks)

27. The diagram in fig 5.0 shows a section of a pipe with different cross-sectional area.



If water flows with a velocity of 10 m/s in section A, what would be the velocity of water in section B ?(2marks)

28. The figure below shows a pulley system being used to raise a load.

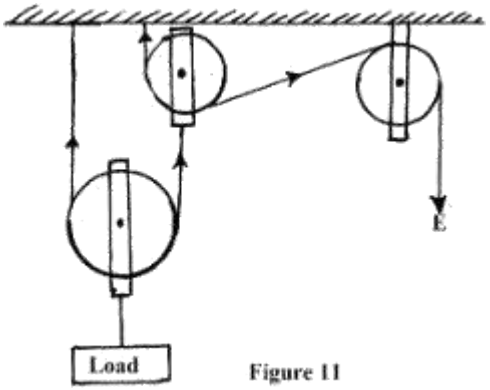


Figure 11

This pulley system has an efficiency of 75%.

i. Determine the velocity ratio of the system. (1mk)

ii. Calculate the mechanical advantage of the pulley system. (2mks)

iii What effort is required to raise a load of 240 kg? (2mks)

iv. Calculate the work done by a person using this machine in raising a load of 120 kg through a vertical distance of 2.5 m (3mks)

29. Give two reasons to explain why the efficiency of a machine cannot be 100%. (2mks)

_____

_____

30. The Figure below shows a graph of velocity against time for a moving body

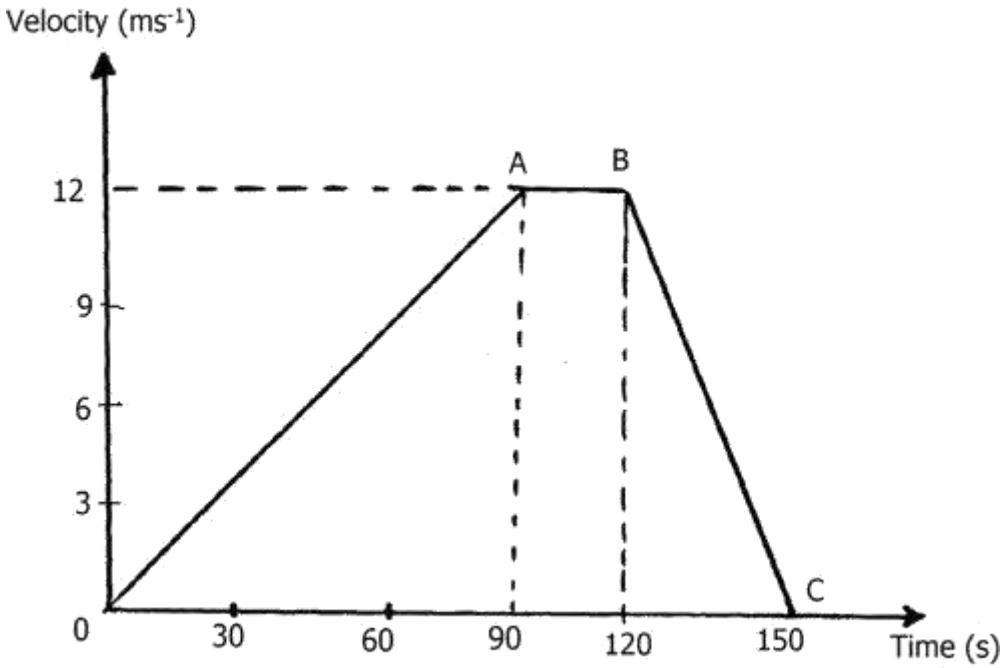


Figure 7

a.

i. Describe the motion between O and A (2mks)

ii. Determine the acceleration between A and B (2mks)

b. A body moving initially at 50 ms^{-1} decelerates uniformly at 2 ms^{-2} until it comes to rest. What distance does it cover from the time it started to decelerate (3mks)

c. The initial velocity of a body of mass 50 kg is 10 ms^{-1}. A constant resultant force of 15 N is then applied. How long will it take before the kinetic energy doubles (3mks

31. Design an experiment to **demonstrate conservation of mechanical energy** using a swinging pendulum. Describe apparatus, procedure, and expected observations. (5 marks)

32. An escalator raises people vertically through 5 m in 10 s. If a person weighs 600 N, calculate the **power developed**. (4 marks)

33. Compare and contrast **kinetic energy and potential energy** in terms of:
    a) Energy transformation (2 marks)

    b) Applications in daily life (3 marks)

34. A lever lifts a load of 200 N through 0.5 m using an effort of 50 N applied over 2 m.
    a) Calculate the **work done by the effort**. (3 marks)

    b) Determine the **efficiency** of the lever. (2 marks)

WAVES & OPTICS

SUB-STRAND: 2.1 PROPERTIES OF WAVES

1. Define a **wave**. (2 marks)

2. State what is meant by **rectilinear propagation** of light. (2 marks)

3. Define **reflection of waves**. (2 marks)

4. State the **law of reflection**. (3 marks)

5. Define **refraction of waves**. (2 marks)

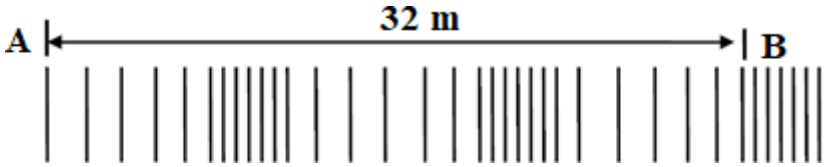
6. What is meant by **diffraction** of waves? (2 marks)

7. Define **interference of waves**. (2 marks)

8. State what is meant by the **Doppler effect**. (2 marks)

9. Explain with a diagram **rectilinear propagation of light** using a pinhole camera. (3 marks)

10. The diagram below shows waves generated from a tuning fork. If the wave takes 0.1 second to move from point A to B. determine the frequency of the wave. (4 marks)



11. Sketch and describe the **reflection of a wave** from a plane surface. (3 marks)

12. Explain **refraction of waves** when a wave passes from air into water. Include a labeled diagram. (3 marks)

13. Describe an experiment to demonstrate **diffraction of light** using a narrow slit. (3 marks)

14. Explain how **interference of waves** is demonstrated using two coherent sources of water waves. (3 marks)

15. A stationary wave is set up on a string of length 1.2 m fixed at both ends. Draw the first two modes of vibration and explain **nodes and antinodes**. (3 marks)

16. Explain how **resonance** occurs in a vibrating air column, giving one practical application. (3 marks)

17. Describe an experiment to demonstrate **formation of stationary waves** on a stretched string. (3 marks)

18. Explain how a **frequency-modulated (FM) wave** is produced and detected. (3 marks)

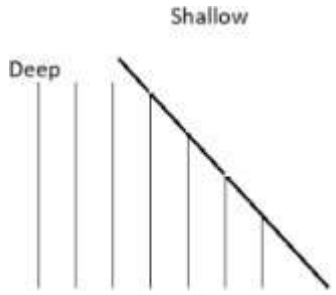
19. Explain why **stationary waves** do not transport energy along the medium. (3 marks)

20. Describe **one real-life application of stationary waves**. (2 marks)

21. Explain qualitatively the **Doppler effect** observed when an ambulance approaches and recedes from an observer. (3 marks)

22. Sketch and describe the **pattern of constructive and destructive interference**. (3 marks)

23. A boy observed water waves travelling from a deep region to a shallow region as show below.



(i) Sketch the appearance of the waves after crossing the shallow region. (1 mark)

(ii) Given that the frequency of the waves is 50Hz and the distance between the wave front in the deep region is 2 cm, determine the speed of the waves in the deep region. (2 marks)

24. Explain how **diffraction** affects the spreading of sound around obstacles. (3 marks)

_____

_____

_____

25. A wave travels along a string at 10 m/s. If the wavelength is 0.5 m, calculate its **frequency**. (2 marks)

_____

_____

24. Discuss how the **Doppler effect** is used in measuring the speed of vehicles and in astronomy. (4 marks)

_____

_____

25. A string 1 m long is fixed at both ends and vibrates in its second harmonic.
a) Draw the wave pattern showing nodes and antinodes. (3 marks)

b) Explain how the **wavelength** relates to the length of the string. (2 marks)

26. Explain with examples how **stationary waves** are applied in musical instruments like guitars and flutes. (5 marks)

27. A beam of light passes from air into water. Draw a diagram showing the angle of incidence and angle of refraction. Explain **why the light bends towards the normal**. (4 marks)

28. Describe a demonstration to show **interference of sound waves** using two tuning forks of the same frequency. Explain the observations. (5 marks)

29. Explain qualitatively how **diffraction and interference** affect **radio wave transmission around buildings** in a city. (4 marks)

30. A string 0.8 m long is fixed at both ends. If the speed of the wave along the string is 16 m/s, calculate:
a) The frequency of the fundamental mode. (3 marks)

b) Sketch the fundamental mode showing nodes and antinodes. (2 marks)

SUB-STRAND: 2.2 RADIOACTIVITY AND STABILITY OF ISOTOPES

1. Define **radioactivity**. (2 marks)

2. State what is meant by an **isotope**. (2 marks)

3. Define **half-life** of a radioactive element. (2 marks)

4. List the three main types of radioactive emissions. (3 marks)

5. State one property of **alpha (α) particles**. (2 marks)

6. State one property of **beta (β) particles**. (2 marks)

7. State one property of **gamma (γ) rays**. (2 marks)

8. Mention one safety precaution when handling radioactive materials. (2 marks)

9. Explain how **radionuclides attain stability** using **nuclear equations**. Give an example. (3 marks)

10. A sample of uranium-238 emits an alpha particle. Write the nuclear equation showing the new nuclide formed. (3 marks)

11. Explain the qualitative difference between **nuclear fission** and **nuclear fusion**. (3 marks)

12. Explain how a **Geiger-Muller tube** detects radiation. (3 marks)

13. Describe how a **cloud chamber** can be used to observe radioactive emissions. (3 marks)

14. Explain how **half-life** can be determined graphically from a decay curve. (3 marks)

15. A radioactive isotope has a half-life of 4 hours. If 80 g of the isotope is present initially, calculate the remaining amount after 8 hours. (3 marks)

16. Describe the **ionizing effect** of alpha, beta, and gamma radiation. (3 marks)

17. Explain why **gamma rays** are more penetrating than alpha or beta particles. (3 marks)

18. A leaf electroscope is used to detect radioactive emissions. Explain the working principle. (3 marks)

19. Explain the concept of a **chain reaction** in nuclear fission. (3 marks)

20. Describe two **medical applications** of radioactivity. (3 marks)

21. Explain how **industrial applications** of radioactivity are beneficial, giving one example. (3 marks)

22. Explain why **nuclear reactions** produce more energy than chemical reactions. (3 marks)

23. Describe the precautions to take when using radioactive substances in hospitals. (3 marks)

24. A sample of a radioactive isotope decays from 160 g to 20 g in 12 hours.
    a) Determine the number of half-lives that have elapsed. (3 marks)

    b) Calculate the half-life of the isotope. (2 marks)

25. Write the nuclear equation for the **beta decay of carbon-14**. (3 marks)

26. Explain qualitatively how **nuclear fission of uranium-235** produces a chain reaction, including the role of neutrons. (4 marks)

27. Discuss the advantages and dangers of using **radioactive isotopes in agriculture**. (5 marks)

28. Explain how **carbon dating** uses the concept of half-life to estimate the age of archaeological samples. (4 marks)

29. A nuclear reactor uses uranium-235 for energy production. Explain how the **principle of conservation of mass and energy** applies in the reactor. (5 marks)

30. Compare and contrast **nuclear fission and nuclear fusion** in terms of:
    a) Energy released (2 marks)

    b) Applications (2 marks)

    c) Safety concerns (2 marks)

31. What is meant by the following terms:

a. Radioactive decay

b. isotope.

32. The table shows how the activity (disintegrations per minute) of a sample of carbon-14 varies with time (in years).

Time (grs)	0	2500	5000	7500	10000	12500	17250	20000
Disintegration/min	15	11	8	5	4.0	3.2	1.6	1.2

a. Plot a graph of activity against time (x-axis).

b. Estimate the half-life of carbon-14 from the graph.

33.

a. Draw a labeled diagram of a Geiger- Muller tube.

b. Explain how it detects radioactive particles/rays.

2. State one use of radioactivity in each of the following;

a. Medicine

_____

_____

b. Agriculture.

_____

_____

c. Radon gas $^{222}_{86}Rn$ decays by emission of α particles. Show by use of an equation the transformation of the gas.

d. Give two uses of cobalt - 60 as a Radioactive source.

_____

_____

34. One of the isotopes of Uranium has a half life of 576 hours.

i. Complete the table to show how the mass varies with time from an initial mass of 1280 mg.

Time (Hours)	576	1152	1728	2304
Mass (mg)				

ii. Explain whether the mass of the isotope will eventually reduce to zero.

_____

_____

35. State two factors that determine the extent of the damage to the body cell caused by the radiation from radioactive substances.

36. How many neutrons does the nuclide $^{235}_{92}U$ contain?

37. Name the quantities, which must be measured so as to determine the half-life of a radioactive sample whose half-life is known to be a few hours.

38. Explain why α particles are more ionizing than β particles.

39. A radioactive carbon -14 decays to Nitrogen by beta emissions as shown.

$$^{14}_{6}C \rightarrow {}^{x}_{7}N + {}^{0}_{y}\beta$$

Determine the values of x and y in the equation.

40. Alpha particles are more ionizing than Beta particles. Give one reason for this.

41. In a sample there are 5.12×10^{20} atoms of Krypton 92 initially. If the half-life of Krypton is 3.0s, determine the number of atoms that will have decayed after 6s

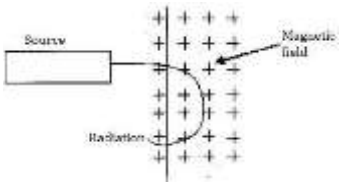
42. Cobalt 60 is a radioisotope that has a half-life of 5.25 years. What fraction of the original atoms in a sample will remain after 21 years.

43. A nucleus is represented by $^{107}_{32}X$
State the number of neutrons in a nucleus.

_____

_____

44. The figure below shows the path of radiation from a radioactive source after entering a magnetic field. The magnetic field is directed into the paper and is perpendicular to the place of the paper shown in the figure below.



i. Identify the radiation.

_____

ii. Give a reason for your answer in (i) above

_____

_____

_____

45. Below is a nuclear reaction

$$^{232}_{90}A \longrightarrow {}^{Y}_{X}B + {}^{4}_{2}K + \gamma \text{ (gamma)}$$

ELECTROSTATICS

SUB-STRAND: 3.1 ELECTROSTATICS

1. Define **electric charge**. (2 marks)

2. State the SI unit of electric charge. (2 marks)

3. Define **conductor** and **insulator**. (2 marks)

4. State **Coulomb's law** in words. (3 marks)

5. Define the **electric field**. (2 marks)

6. Mention one method of **charging a conductor**. (2 marks)

7. State one property of **charged conductors**. (2 marks)

8. Mention one application of **electrostatics** in daily life. (2 marks)

9. Explain the origin of charge in a material at the atomic level. (3 marks)

10. Describe how a conductor can be charged by **contact**. (3 marks)

11. Describe how a conductor can be charged by **induction**. (3 marks)

12. Draw a labeled diagram showing **charge distribution on a spherical conductor**. (3 marks)

13. Draw a labeled diagram showing **charge distribution on a sharp/pointed conductor**. (3 marks)

14. Explain the **charging process of a leaf electroscope** by contact. (3 marks)

15. Explain the **charging process of a leaf electroscope** by induction. (3 marks)

16. Describe how an electroscope can be used to **test for the presence of charge**. (3 marks)

17. Describe how an electroscope can be used to **determine the type of charge**. (3 marks)

18. Explain how an electroscope can be used to **compare the quantity of charges** on two objects. (3 marks)

19. Explain qualitatively the **force between two point charges** using Coulomb's law. (3 marks)

20. Explain why **charges accumulate at sharp points** on conductors. (3 marks)

21. Describe an experiment to demonstrate **charging by friction**. (3 marks)

22. Explain why **metallic conductors** allow charge to move freely but non-metallic materials do not. (3 marks)

23. Explain how **electrostatic precipitators** are used in pollution control. (3 marks)

24. Two point charges, +3 μC and -2 μC, are placed 0.5 m apart.
    a) Draw a diagram showing the **forces between the charges**. (2 marks)

    b) Explain the **direction of the forces** on each charge. (3 marks)

25. Compare and contrast **charging by contact and induction** in terms of charge transfer and conductor behavior. (5 marks)

26. Explain how a **photocopier uses electrostatics** to transfer ink to paper. (4 marks)

27. Describe the **distribution of charges on a wedge-shaped conductor** and explain why it is used in electrostatic experiments. (4 marks)

28. A pointed conductor is connected to the earth. Explain why this prevents **dangerous accumulation of charges** during lightning. (4 marks)

29. Design an experiment to **demonstrate charge distribution** on different shaped conductors using a leaf electroscope. Include **procedure, expected observations, and explanation**. (5 marks)

30. Discuss **five real-life applications of electrostatics** and explain the physics behind each. (5 marks)

SUB-STRAND: 3.2 CURRENT ELECTRICITY

1. Define **electric current**. (2 marks)

2. State the SI unit of electric current. (2 marks)

3. Define **potential difference**. (2 marks)

4. Define **resistance**. (2 marks)

5. State **Ohm's law** in words. (3 marks)

6. Mention one method to determine the resistance of a resistor. (2 marks)

7. State what is meant by **internal resistance** of a cell. (2 marks)

8. Mention one application of electric current in **heating**. (2 marks)

9. Draw a **circuit diagram** to verify Ohm's law and explain the procedure. (3 marks)

10. A conductor has a potential difference of 12 V across it and a current of 2 A flowing through it. Calculate its resistance. (3 marks)

11. Explain how a resistor can be **classified as ohmic or non-ohmic**. (3 marks)

12. Describe how the **length of a wire** affects its resistance. (3 marks)

13. Describe how the **cross-sectional area of a wire** affects its resistance. (3 marks)

14. Explain qualitatively how **temperature affects the resistance** of a metal conductor. (3 marks)

15. A resistor has a color code **brown, black, red**. Determine its resistance. (3 marks)

16. Draw and explain the graph of **current against potential difference** for an ohmic conductor. (3 marks)

17. Draw and explain the graph of **current against potential difference** for a non-ohmic conductor. (3 marks)

18. Explain how a **metre bridge or Wheatstone bridge** can be used to determine the resistance of a wire. (3 marks)

19. Describe how **resistors can be connected in series** and determine the **effective resistance**. (3 marks)

20. Describe how **resistors can be connected in parallel** and determine the **effective resistance**. (3 marks)

21. A 12 V battery is connected across a resistor of 6 Ω. Determine the current flowing. (3 marks)

22. Explain the **heating effect of current** and write its relationship with potential difference, current, resistance, and time. (3 marks)

23. Discuss the applications of resistors in **day-to-day life**. (3 marks)

24. Derive the relationship between **emf (E), internal resistance (r), current (I), and external resistance (R)** of a circuit. (4 marks)

25. A cell of emf 1.5 V and internal resistance 0.5 Ω is connected to an external resistor of 4.5 Ω. Calculate:
    a) Current in the circuit (2 marks)

    b) Terminal voltage (2 marks)

26. A wire of length 2 m, cross-sectional area 1 mm^2, and resistivity 1.7×10^{-8} Ωm is connected to a 12 V source. Calculate its resistance and current if connected directly. (5 marks)

27. Explain how **resistor networks** are used in electronic devices to control current and voltage. (4 marks)

_____

_____

_____

28. Discuss and compare **series and parallel connections of resistors** in terms of:
    a) Total resistance (2 marks)

b) Current distribution (2 marks)

c) Applications (2 marks)

29. Explain how **heating effect of current** is applied in household appliances, giving two examples with calculations for power dissipated. (5 marks)

30. Design an experiment to investigate **the relationship between potential difference, current, and resistance** for different conductors. Include:
    a) Apparatus and procedure (2 marks)

b) Expected results and graph (3 marks)

SECTION D

1. **A student learnt that a battery of eight dry cells each 1.5v has a total e.m.f of 12V the same as a car battery. He connected in series eight new dry batteries to his car but found that they could not start the engine. Give a reason for this observation**

2.

a. **You are required to determine the resistance per unit length of a nichrome wire x, you are provided with A.D.C. power supply an ammeter and voltmeter.**

i. **Draw a circuit diagram to show how you would connect the circuit.**

ii. **Describe how you would use the circuit in (a) (i) above to determine the resistance per unit length of x.**

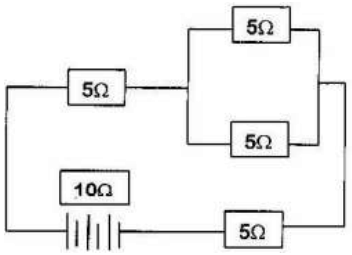
b.

i. **State Ohm's Law.**

ii. **A filament lamp and a thermostat are ohmic devices to a certain extent. Explain.**

c. **Explain why moving coil meters are unstable for the use of alternating voltages.**

d. **Four 5Ω resistors are connected to a 10V d. c. supply as shown in the diagram below.**

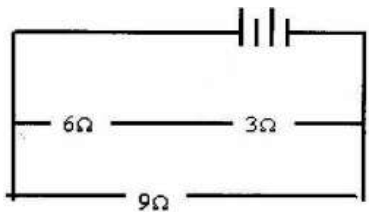


Calculate;-

i. **The effective resistance in the circuit.**

ii. **The current I following in the circuit.**

3. **Study the circuit diagram. Determine the potential drop across the 3 resistor.**



4. **State two conditions that are necessary for a conductor to obey Ohm's law.**

_____

_____

_____

5. .

a. **State Ohm's law.**

b. **Describe with aid of a diagram and experiment to verify Ohm's law**

c. **Two resistors R1 and R2 are connected in series to a 10V battery. The current flowing then is 0.5A. When R1 only is connected to the battery the current flowing is 0.8A.**

i. **Value of R2**

ii. **Current flowing when R1 and R2 are connected in parallel with the same batter.**

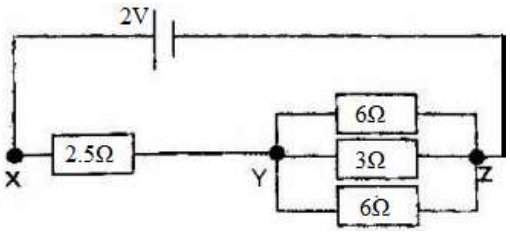
d. **Recharging is one of the practices of maintenance of accumulators. State two measurements, which need to be taken to help you decide when an accumulator is due for charging.**

6. **A current of 0.08A passes in circuit for 2.5 minutes. How much charge passes through a point in the circuit?**

7. **An ammeter, a voltmeter and a bulb are connected in a circuit so as to measure the current flowing and the potential difference across both. Sketch a suitable circuit diagram for the arrangement.**

8.

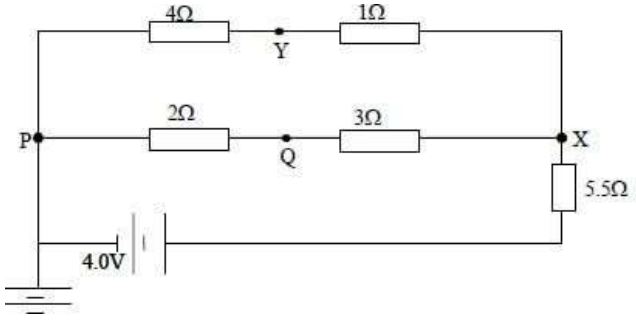
a. **In the circuit diagram shown, calculate the effective resistance between Y and Z.**



b. **Determine the current through the 3Ω resistor.**

c. **One of the 6Ω resistors has a length of 1m and cross-sectional area of 5.0 x 10-5m2. Calculate the resistivity of the material.**

9. **In the circuit diagram five resistors are connected to a battery of e.m.f. 4V, and negligible internal resistance. Determine:**



i. **The total resistance of the circuit.**

ii. **The current flowing through the 5.5Ω resistor.**

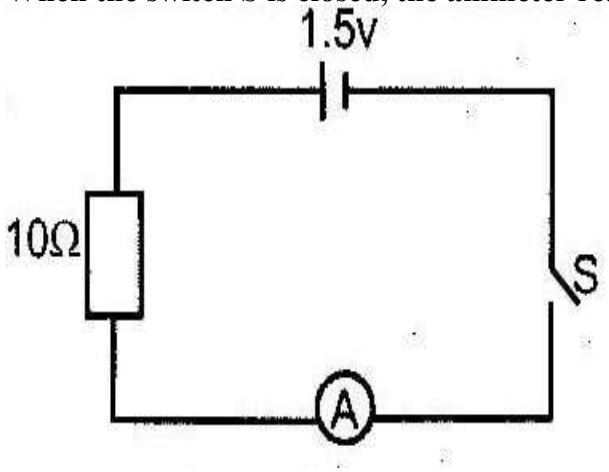
iii. **The potentials at points Y and Q.**

iv. **The potential difference between Y and Q**

10. **An electric bulb with a filament of resistance 480Ω is connected to a 240V mains supply. Determine the energy dissipated in 2 minutes.**

11. **A student wishes to investigate the relationship between current and voltage for a certain device X. In the space provide, draw a circuit diagram including two cells, rheostat, ammeter, voltmeter and the device X that would be suitable in obtaining the desired results.**

12. **In the circuit diagram shown in the figure below, the ammeter has negligible resistance. When the switch S is closed, the ammeter reads 0.13A.**

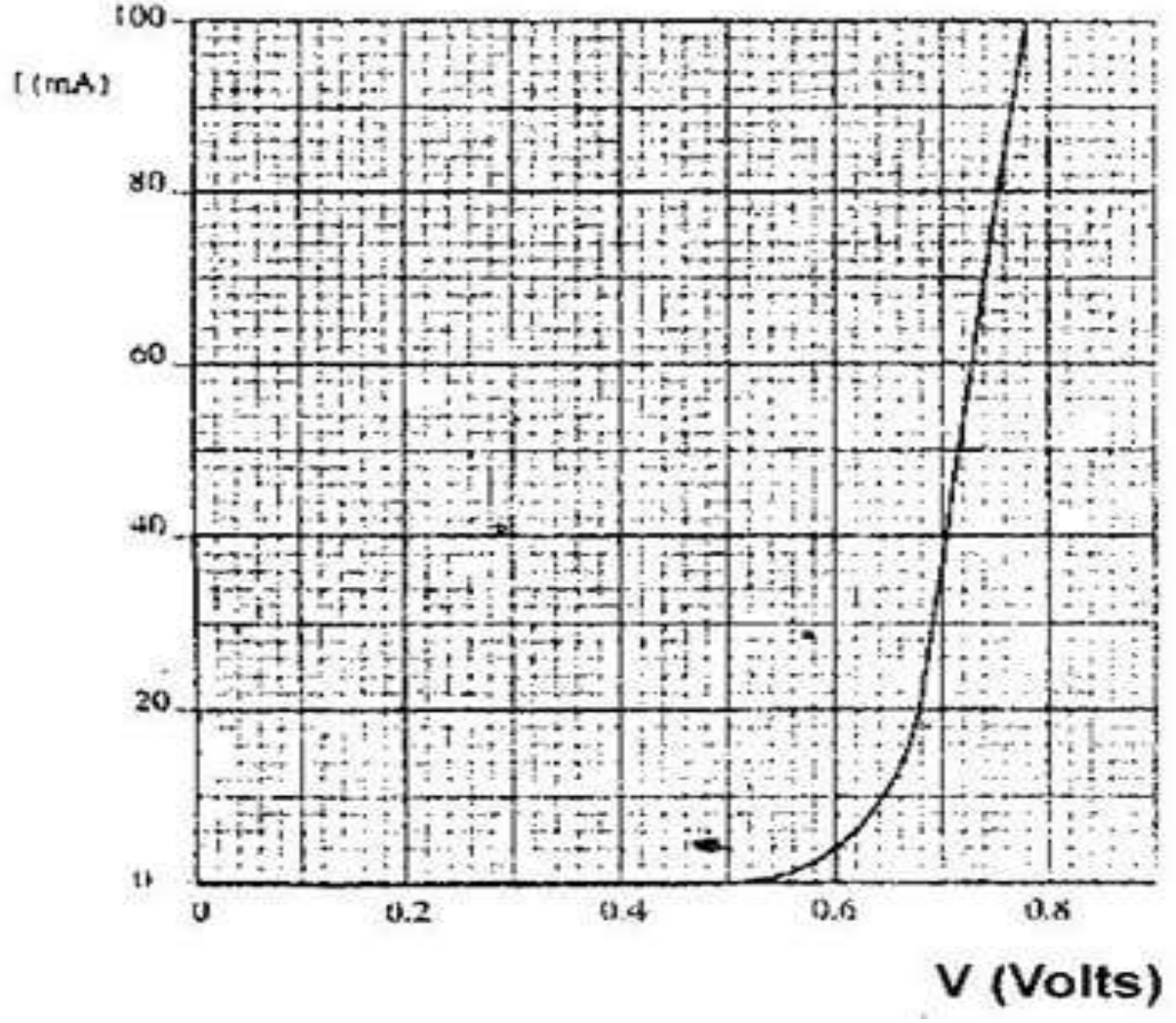


Determine the internal resistance of the cell.

13.

a. **State Ohm's law.**

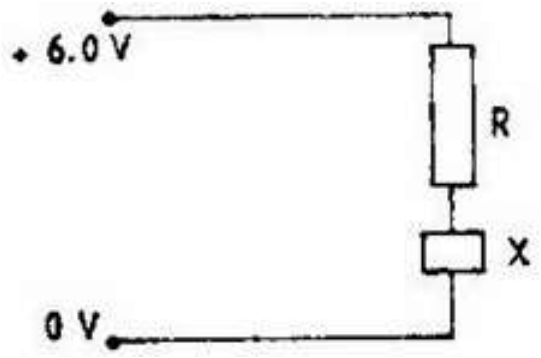
b. **The graph in the figure below shows the current voltage characteristics of a device, X.**



i. **State with a reason whether the device obeys Ohm's laws.**

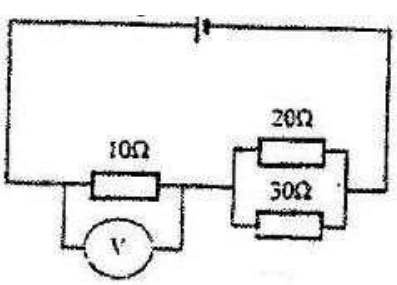
ii. **Determine the resistance of the device, X, when the current through it is 60m A.**

iii. **When the device, X, is connected in the circuit below, the voltage across it is 0.70V.**



Calculate the value of the resistance R.

c. **The cell in the figure below has an emf of 2.1V and negligible internal resistance.**



Determine the

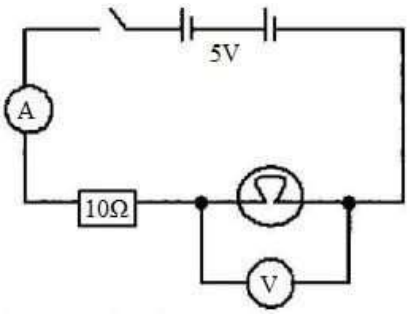
i. **Total resistance in the circuit.**

ii. **Current in the circuit**

iii. **Reading on the voltmeter**

14. **State two advantages of an alkaline battery over a lead acid battery**

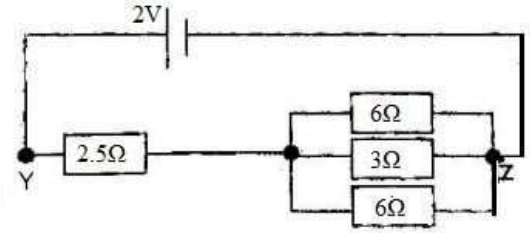
15. **The diagram below shows an electrc circuit. When the switch is close the ammeter reading is 0.3A**



Determine the voltmeter reading.

16.

a. **In the circuit diagram shown, calculate the effective resistance between Y and Z**



b. **Determine the current through the 3Ω resistor.**

17. **A battery of e.m.f. 3v drives a current through a 20Ω resistor. The p.d across the resistor is 2.8v as measured by a voltmeter. Calculate the internal resistance of the battery.**

18. **A torch uses two identical dry cells connected in series. When a bulb of resistance 2.0 ohm's is connected across the cells the pd across the bulb is 2.0 v. When a bulb of resistance 1.5 ohms is used, the p.d is 1.8v, calculate the e.mf and internal resistance of each cell.**

19. **Suppose a high–resistance voltmeter reads 1.5v connected across a dry battery on open circuit and 1.2v. when the same battery is in a closed circuit when it is supplying a current of 0.3A through a lamp of resistance R.**

a. **Draw a circuit diagram to show the above experiment when in;**

i. **Open circui**

ii. **Closed circuit.**

b. **What is**

i. **The emf of the battery.**

ii. **The internal resistance of the battery**

iii. **The value of R?**

20. **When a resistor is connected across the terminals of a battery a current of 0.20 A flows.**

a. **What is the time taken for 2.0 coulombs of charge to pass a given point in the circuit?**

b. **If e.m.f of the battery is 4.0v and its internal resistance is 0.20hm determine the rate at which heat is produced in the resistor.**

21.

a. **State Ohm's law.**

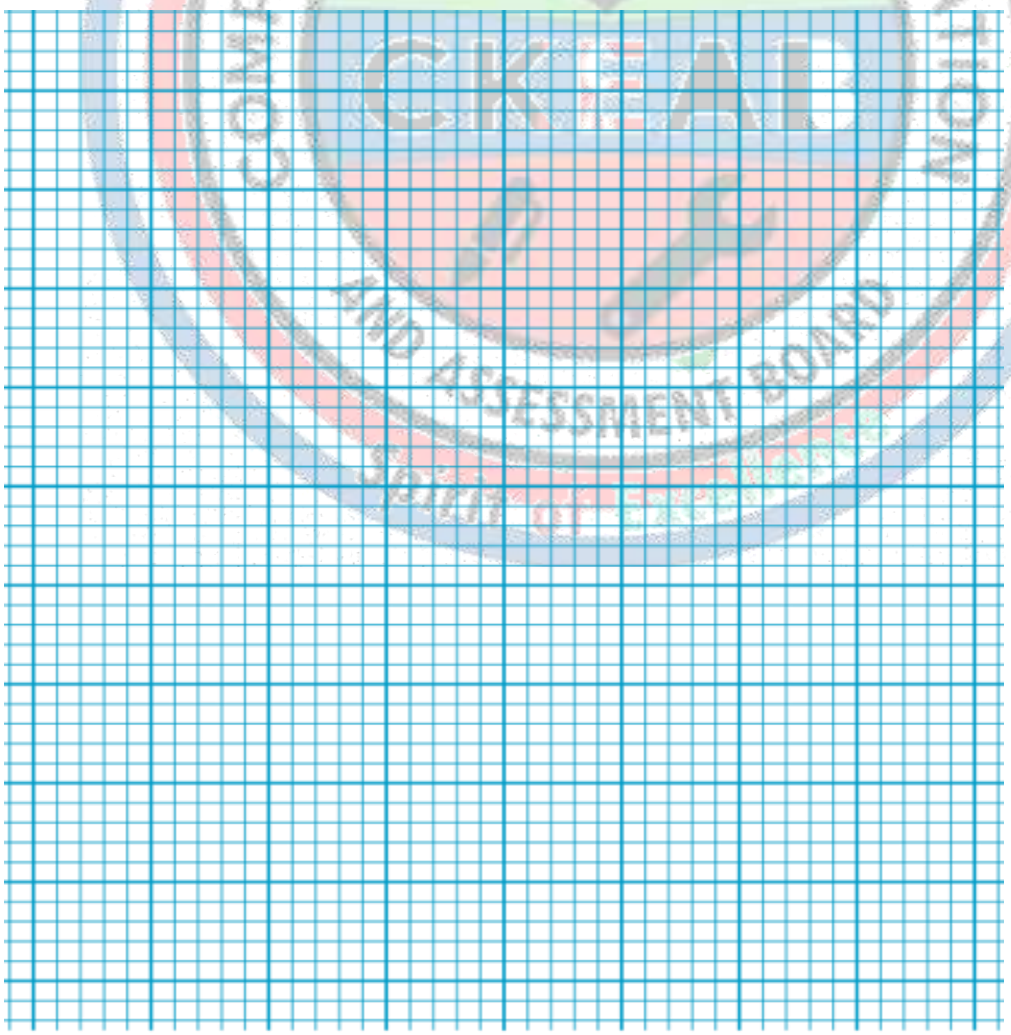
b. **In an experiment to determine the resistance of a resistor x, it is connected in parallel with a 100 Ω resistor. The current through the combination and the p.d across the combination is tabulated as shown below.**

Potential difference (v)	**1.5**	**3.0**	**4.5**	**6.0**	**7.5**
Current (A)	**0.075**	**0.015**	**0.225**	**0.30**	**0.375**

Draw a diagram of the circuit that could have been used

c.

i. **plot a graph of current against potential difference.**



ii. **Calculate the gradient of the slope**

iii. **Calculate the resistance of resistor x.**

SUB-STRAND: 3.3 INTRODUCTION TO ELECTRONICS

1. Define a **conductor**. (2 marks)

2. Define an **insulator**. (2 marks)

3. Define a **semiconductor**. (2 marks)

4. Define a **superconductor**. (2 marks)

5. State one example of a **conductor** and one example of an **insulator**. (3 marks)

6. State the effect of temperature on the resistance of a **metal conductor**. (2 marks)

7. State one use of a **superconductor** in daily life. (2 marks)

8. Mention one example of a **semiconductor**. (2 marks)

9. Distinguish between **conductor and insulator** in terms of electron movement. (3 marks)

10. Explain why semiconductors have **intermediate conductivity** between conductors and insulators. (3 marks)

11. Draw the **energy band diagram** for a conductor, showing valence and conduction bands. (3 marks)

12. Draw the **energy band diagram** for an insulator. (3 marks)

13. Draw the **energy band diagram** for a semiconductor. (3 marks)

14. Explain the difference between **intrinsic and extrinsic semiconductors**. (3 marks)

15. Describe how an **n-type semiconductor** is formed from an intrinsic semiconductor. (3 marks)

16. Describe how a **p-type semiconductor** is formed from an intrinsic semiconductor. (3 marks)

17. Explain how the **resistance of a semiconductor changes with temperature**. (3 marks)

18. Explain the behavior of **conductors with varying temperature**. (3 marks)

19. Explain the behavior of **insulators with varying temperature**. (3 marks)

20.

21. Describe two applications of **conductors** in day-to-day life. (3 marks)

22. Describe two applications of **semiconductors** in electronics. (3 marks)

23. Describe two applications of **insulators** in household appliances. (3 marks)

24. Explain why **superconductors have zero resistance at very low temperatures**. (3 marks)

24. A semiconductor's conductivity increases with temperature. Explain using **energy band theory** why this happens. (4 marks)

25. Compare and contrast **n-type and p-type semiconductors** in terms of charge carriers and doping elements. (4 marks)

26. Discuss the **advantages of semiconductors over conductors and insulators** in electronic devices. (4 marks)

27. Explain how **superconductors are used in magnetic levitation (Maglev trains)**. (4 marks)

28. A certain intrinsic semiconductor has an energy gap of 1.1 eV. Explain qualitatively how adding pentavalent impurities changes its conductivity. (3 marks)

29. Design an experiment to investigate the **effect of temperature on the conductivity of a semiconductor**. Include:
a) Apparatus and procedure (2 marks)

b) Expected results and explanation (3 marks)

30. Discuss the **applications of conductors, semiconductors, insulators, and superconductors** in modern electronics and everyday life, giving at least one example for each. (5 marks)

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ENVIRONMENTAL AND SPACE PHYSICS

SUB-STRAND: 4.1 GREENHOUSE EFFECT AND CLIMATE CHANGE

1. Define the **greenhouse effect**. (2 marks)

2. Define **climate change**. (2 marks)

3. State the role of the **ozone layer** in protecting the Earth. (2 marks)

4. Define **global warming**. (2 marks)

5. Mention two **greenhouse gases**. (2 marks)

6. State one human activity that contributes to **greenhouse effect**. (2 marks)

7. Mention one effect of climate change on **water bodies**. (2 marks)

8. State one **mitigating factor** against climate change. (3 marks)

9. Explain the mechanism of the **greenhouse effect** in the atmosphere. (3 marks)

10. Using an example, explain how **a car parked with closed windows in the sun** demonstrates the greenhouse effect. (3 marks)

11. Describe the role of **human activities** in escalating global warming. (3 marks)

12. Explain the effect of depletion of the **ozone layer** on climate change. (3 marks)

13. Describe two ways in which **climate change affects vegetation**. (3 marks)

14. Describe two ways in which **climate change affects water bodies** (rivers and lakes). (3 marks)

15. Explain the difference between **global warming and climate change**. (3 marks)

16. Discuss the contribution of **industrial emissions** to greenhouse effect. (3 marks)

17. Describe the impact of **deforestation** on climate change. (3 marks)

18. Explain how **carbon dioxide and methane** contribute to the greenhouse effect. (3 marks)

19. Explain the effect of **climate change on weather patterns**. (3 marks)

20. Outline three **mitigating factors against climate change** in the environment. (3 marks)

21. Explain the importance of the **ozone layer in reducing UV radiation**. (3 marks)

22. Describe how **solar radiation is trapped by greenhouse gases** in the atmosphere. (3 marks)

23. Discuss how **agricultural activities contribute to greenhouse effect**. (3 marks)

24. Analyze the relationship between **global warming, greenhouse effect, and climate change**. (4 marks)

25. Evaluate the impact of **climate change on biodiversity** in your local environment. (4 marks)

26. Suggest a detailed plan to **mitigate greenhouse effect** in an urban area. Include three strategies. (4 marks)

27. Explain how the **melting of ice caps** is related to climate change and global warming. (4 marks)

28. Using a diagram, illustrate the **greenhouse effect**, labeling greenhouse gases, incoming solar radiation, and outgoing infrared radiation. (3 marks)

29. Discuss the **economic and social implications** of climate change on agriculture and human settlements. (3 marks)

30. Critically assess the role of **renewable energy sources** in reducing greenhouse gas emissions. (3 marks)

SUB-STRAND: 4.2 INTRODUCTION TO SPACE PHYSICS

1. Define the **Big Bang Theory**. (2 marks)

2. State two types of **celestial bodies** in the universe. (2 marks)

3. Define **astrophysics**. (2 marks)

4. State one example of a **planetary body** in the solar system. (2 marks)

5. Mention one type of **telescope** used in astronomy. (2 marks)

6. State one historical event in **space exploration**. (2 marks)

7. Mention one **career in space exploration**. (3 marks)

8. Define **planetary motion**. (2 marks)

9. Explain the **Big Bang Theory** of the origin of the universe. (3 marks)

10. Classify celestial bodies in the universe into at least **three types**. (3 marks)

11. Outline the **evolution of astrophysics** as a field of study. (3 marks)

12. Explain the motion of **planets around the Sun** using Newton's laws. (3 marks)

13. Explain the difference between **inner and outer planets** in the solar system. (3 marks)

14. Describe two methods of **space exploration**. (3 marks)

15. Explain how **telescopes** help in observing celestial bodies. (3 marks)

16. Describe the role of **satellites in space exploration**. (3 marks)

17. Discuss the importance of **space probes** in understanding planetary motion. (3 marks)

18. Describe two significant **discoveries in astrophysics**. (3 marks)

19. Explain the relationship between **astrophysics and other branches of physics**. (3 marks)

20. Describe one **instrument used to study stars and galaxies**. (3 marks)

21. Explain how **digital media and simulations** are used to observe celestial bodies. (3 marks)

22. Outline two **historical milestones in space exploration**. (3 marks)

23. Describe the difference between **natural and artificial celestial bodies**. (3 marks)

24. Evaluate the evidence supporting the **Big Bang Theory**. (4 marks)

25. Analyze how the **classification of celestial bodies** aids astronomers in understanding the universe. (4 marks)

26. Compare and contrast **telescopes and space probes** in their effectiveness for space observation. (4 marks)

27. Discuss the factors that influence **planetary motion** in the solar system. (4 marks)

28. Design a simple **model or diagram** to show the **motion of planets around the Sun**, labeling relevant axes and forces. (3 marks)

29. Critically assess the **importance of careers in space exploration** for technological and scientific development. (3 marks)

30. Suggest ways in which **digital media, simulations, and telescopes** can be combined to enhance space research. (3 marks)

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