MINISTRY OF EDUCATION AND CULTURE

STUDENT EDUCATION NUMBER									

Samoa Secondary Leaving Certificate

PHYSICS

2025

QUESTION and ANSWER BOOKLET

Time allowed: 3 Hours & 10 minutes

INSTRUCTIONS

1. You have 10 minutes to read **before** you start the exam.
2. Write your **Student Education Number (SEN)** in the space provided on the top right-hand corner of this page.
3. **Answer ALL QUESTIONS.** Write your answers in the spaces provided in this booklet.
4. If you need more paper to write your answers, ask the supervisor. Write your SEN on all extra sheets used and clearly number the questions. Attach the extra sheets to the appropriate places in this booklet.
5. **All the formulas required are provided on the last page.**

STRANDS		Pages	Time (min)	Weighting
STRAND 1	ENERGY	2-5	45	25
STRAND 2	ELECTRICITY	6-10	45	25
STRAND 3	MAGNETISM	11-16	45	25
STRAND 4	FORCES AND MOTION	17-22	45	25
TOTAL			**180**	**100**

Check that this booklet contains pages 2 - 25 in the correct order and that none of these pages are blank.

HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

STRAND 1 **ENERGY** **WEIGHTING 25**

1. Give an example of a longitudinal wave.

SL 1

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2. One of the properties of plane mirror reflection is lateral inversion.

Define **lateral inversion**.

SL 1

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3. Give **ONE** property of a concave mirror.

SL 1

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4. The Samoa National electricity supply is transmitted at the frequency of 50 Hertz.

Describe the concept of frequency in this situation.

SL 2

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5. Describe the photon model of light.

SL 2

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6. Calculate the gravitational potential energy of the brick that is located at a height of 10m. The mass of the brick is 5,000 grams.

SL 2

7. The specific latent heat of vapourisation of water at 100°C is 2,260,000 J/kg.

Describe the latent heat of vapourisation of water in this situation.

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SL 2

8. In a Young's double slit experiment, slits are separated by 0.3mm, and the screen in placed 2m away. A beam of light consisting of wavelength of 650mm is used.

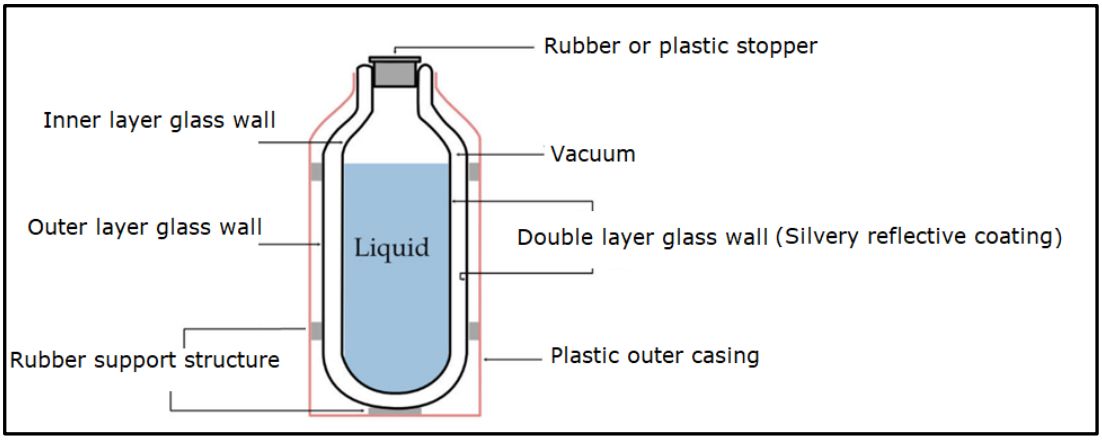
Calculate the distance between the first bright fringe and the central maximum.

SL 3

9. Calculate the energy needed to melt 100 grams of ice at its melting point.

SL 3

10. Given below is a diagram of thermos flask that is used to keep hot or cold liquid for an extended period of time. Explain how the following features of the thermos flask keep hot liquid. The first one has been done for you.



(i) **Vacuum:** The vacuum space between the double layer glass wall reduce heat loss by conduction and convection. As seen in the diagram, heat transfer by conduction is reduced due to the vacuum space between the sides of the inner and outer wall. Also, the vacuum space contains no air for convection to occur, therefore, heat loss is greatly reduced.

SL 4

(ii) Rubber or plastic stopper:

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(iii) The silvery reflecting coating on the double layer glass:

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(iv) Rubber support structure:

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(v) The plastic outer casing:

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11. A bottle of water containing 0.30 kg of water at 25°C is placed in a freezer. The temperature of water dropped to 0°C in 20 minutes.

Calculate the **heat energy lost** by the water as it cooled down to 0°C and the **power** used by the freezer.

SL 4

12. Define the following terms:

Gravitational Potential Energy:

_____

Kinetic Energy:

_____

SL 1

13. Draw the electric field lines of the positive charge given below.

SL 1

14. State any similarity between Newton's gravitational law and Coulomb's law.
(Hint: Use the formulae to compare the two equations).

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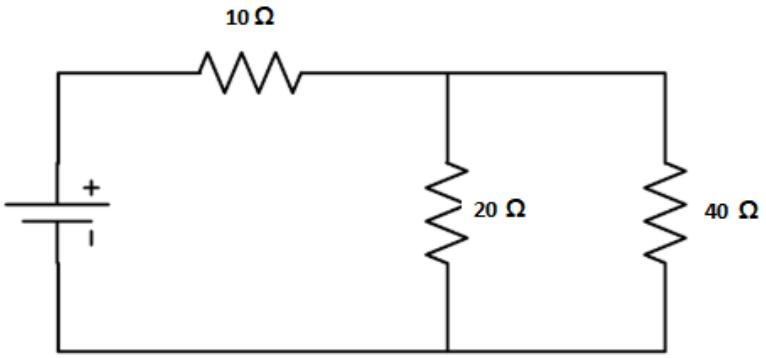
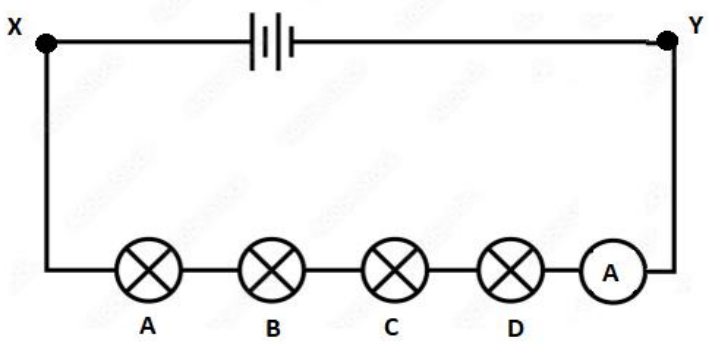
SL 1

15. Calculate the total resistance of the circuit given below.



SL 2

176. Given below are 4 identical light bulbs, A, B, C and D, are all connected in series with an ammeter and batteries. If the resistance of one bulb is 20 Ω, and the ammeter reading is 0.5 ampere, calculate the potential difference across point **X** and **Y**.



SL 2

17. Electroplating is a process where a surface layer of one type of metal is coated with another kind of metal by using electrical current.

Describe how electroplating process is done.

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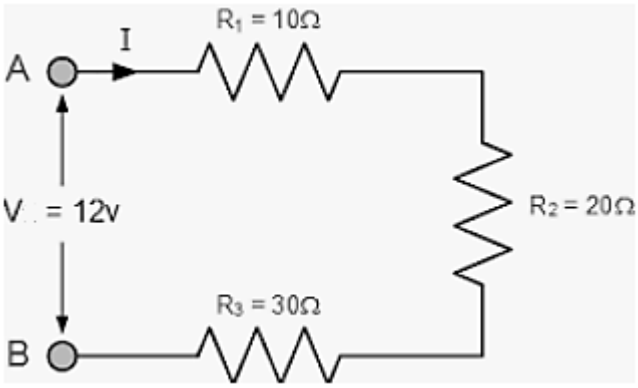
SL 2

18. The circuit given below shows three resistors, R_1, R_2 and R_3 connected in series, with a potential difference of 12V.

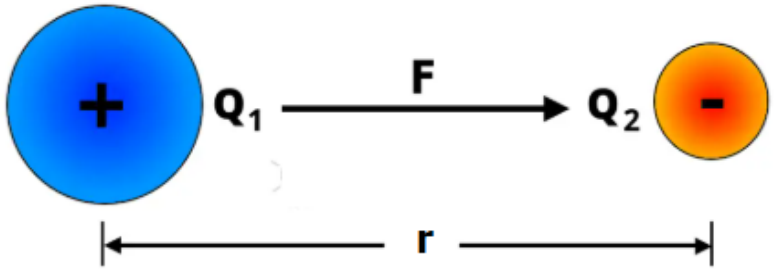
Calculate the electric power consumed by the resistor R_2.



SL 3

19. The size of the electric force between two charged bodies is determined by the formula,

$$F = k\frac{Q_1 Q_2}{r^2}$$



Describe how the size of the force changes as the distance, r, increases between the two charged bodies, Q_1 and Q_2.

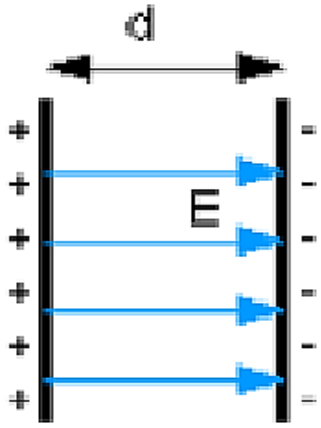
SL 3

20. Describe how capacitor is used in an electric circuit.

SL 3

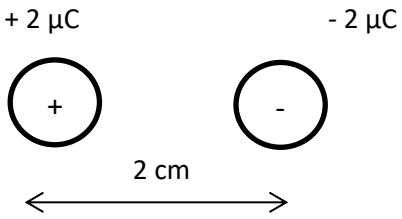
21. Two parallel plates were charged to give electric field strength of E = 1.13 x 10^5 V/m. the distance between the plates is d = 1 mm.

Calculate the voltage required to charge the plates.



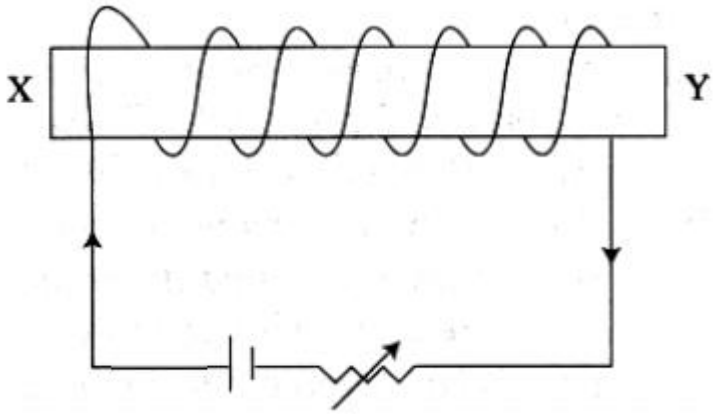
SL 3

22. Two point charges +2 µC and - 2 µC were placed 2 cm from each other. Calculate the electric force between the two charges.



SL 4

23. Determine the poles **X** and **Y** of the electromagnet.



SL 1

24. Give an application of the electromagnet.

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SL 1

25. Give the definition of an 'Isotope'.

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SL 1

26. Describe the Rutherford model of the atom.

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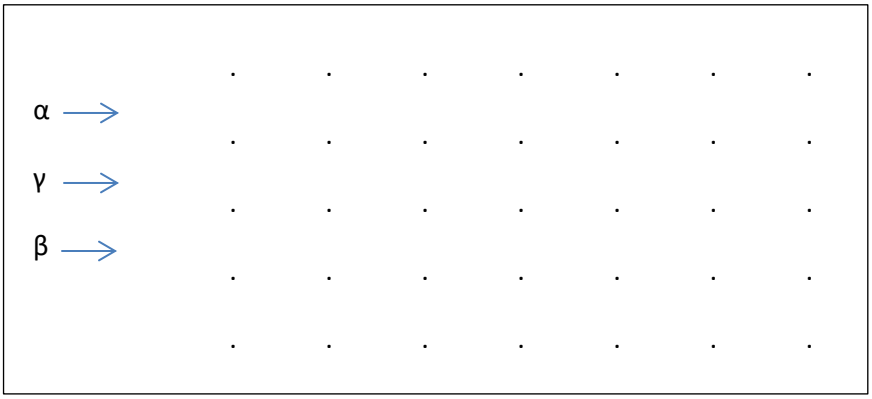
SL 2

27. Describe the path directions taken by three types of radiation particles (alpha, beta and gamma). The particles are travelling to the right through a **magnetic field that is coming out of the page.**

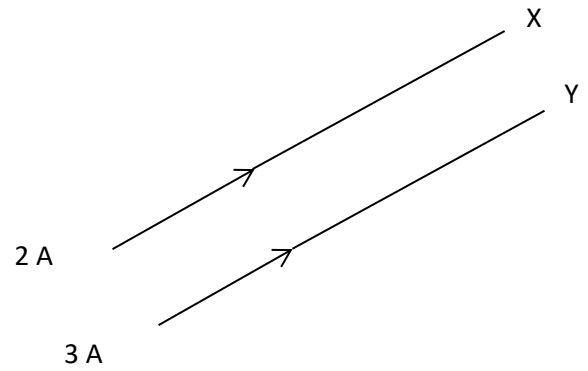


SL 2

28. Describe any **<u>medical application</u>** of atomic radiation.

SL 2

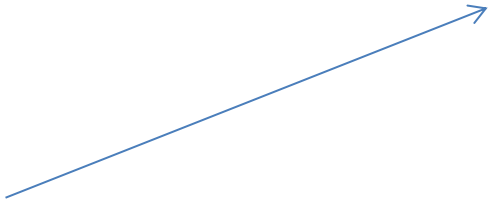
29. Calculate the force experienced by the two electrical conductors, X and Y, placing 3cm from each other. Wire conductor X and Y are carrying electrical current of 2 ampere and 3 ampere respectively. The lengths of the wires are 1 m.



SL 3

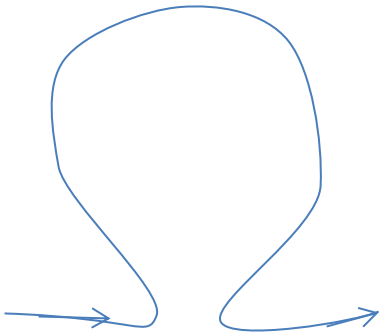
30. Draw the magnetic field pattern for different conductor geometry. The direction of the electric current is given.

Straight line conductor:



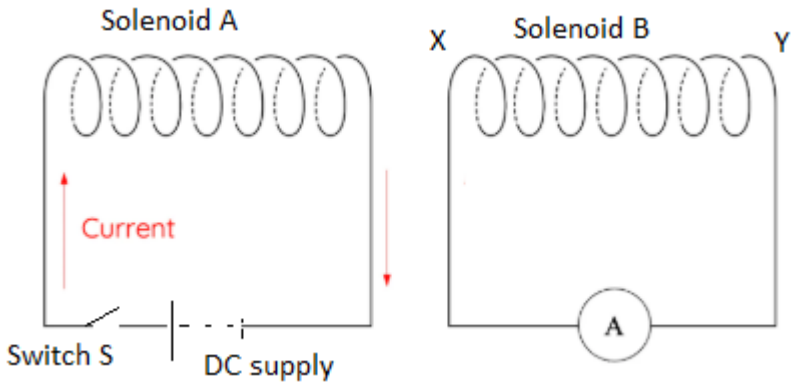
SL 3

Single loop conductor:



Solenoid:

31. Determine the induced polarity of the two sides X and Y of the solenoid B, when switch, S, in solenoid A is closed.



SL 3

32. Explain why transformers can only operate on AC current and not DC current.

SL 3

33. Atomic energy is very useful to society but it needs to be handled with much care.

Discuss with **TWO reasons** why we should evaluate its use in Samoa.

SL 4

34. Define the term **acceleration.**

SL 1

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35. Give the SI units and their notations for the following physical quantities.
The first one has been done for you.

Physical quantities	**Name of the SI unit**	**SI unit Notation**
Time	second	s
Work		
Force		
Energy		
Torque		

SL 1

36. Define a **vector quantity** and a **scalar quantity**.

_____

_____

_____

SL 1

37. Tick the correct box, whether it is vector or scalar quantity from the following list of quantities.

Quantities	**Vector quantity**	**Scalar quantity**
Time		
Acceleration		
Weight		
Torque		
Temperature		

SL 2

38. Describe an everyday situation at which **couple or torque** is applied.

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SL 2

39. A car of mass 5,000 kg moves from rest and reaches a maximum velocity of 20 m/s in 10s. Determine the momentum of the car at the 5^{th} second of its motion.

SL 2

40. Describe in details the motion of an object undergoing a projectile motion.

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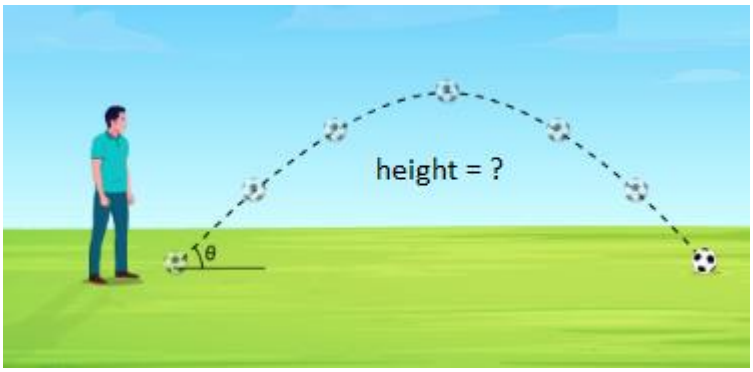
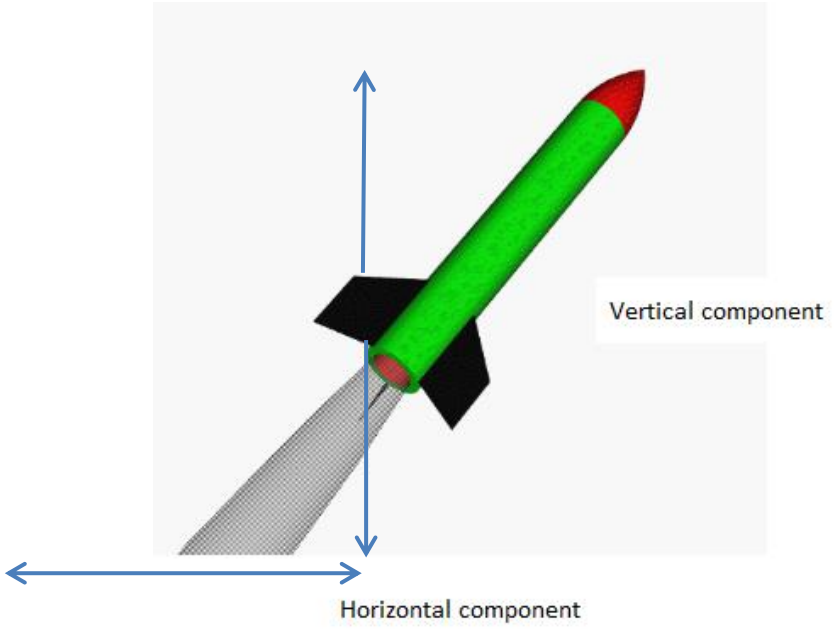
SL 2

41. A soccer ball is kicked from the ground with an initial velocity of 20 m/s at an upward angle of 30°. Calculate the maximum height reached by the ball.



SL 3

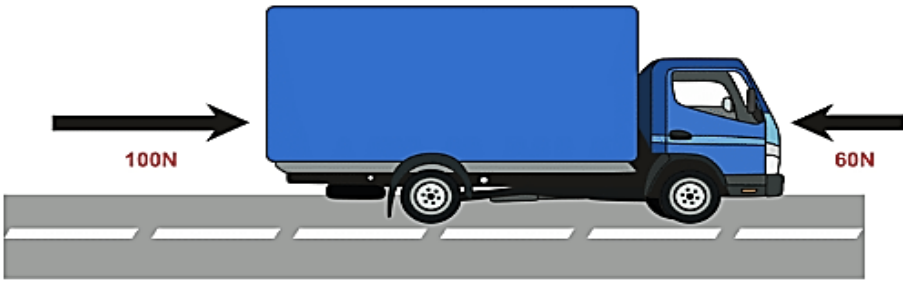
42. Give the **horizontal and vertical velocity component vector** of a projectile fired at angle of 45° above the ground with an initial speed of 30 m/s.



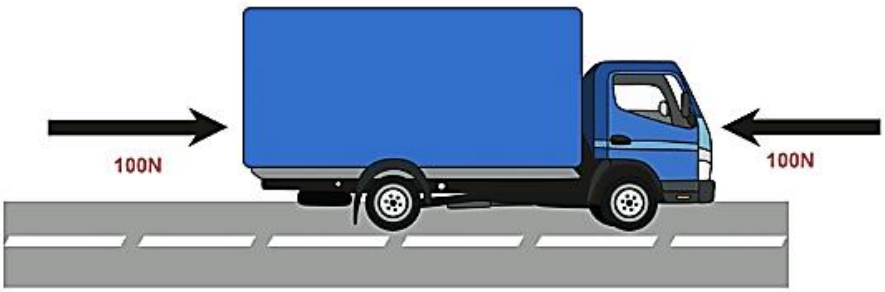
SL 3

43. Study the pictures below and discuss how the forces acting upon the vehicle affect its motion.

[Hint: Use Newton's first and second laws of motion in your discussion].



SL 4



44. A forward force produced by the engine of the car is 15,000 N. Determine the total frictional force produced by the tires if the car is accelerating at 2 m/s^2. The mass of the car is 5000 kg. (Ignore air friction). **[Hint: Use Newton's second law of motion].**

SL 4

PHYSICS EQUATIONS

List of constants

$e = 1.6 \times 10^{-19} C$

$k = 2 \times 10^{-7}\ NA^{-2}$ C $_{water}$ = 4,200 J/kg^{o}C

L $_{vapourisation\ for\ water/steam}$ = 2,260,000 J/kg

L $_{melting\ for\ ice/water}$ = 330,000 J/kg

Melting point of ice = 0 ^{o}C

Boiling point of water = 100 ^{o}C

$m_e = 9 \times 10^{-31} kg$

$G = 6.67 \times 10^{-11} Nm^2 / kg^2$

$k = 9.0 \times 10^{9}\ Nm^2 C^{-2}$

1 atm = 101.3 *kPa*

R = 0.08205 *L atm /mol K*

h = 6.6 x 10-34 Js

mass of the proton = 1.67 x 10^{-27} kg

Kinematics

$$a = \frac{\Delta v}{\Delta t}$$

v = u + at

$$d = ut + \frac{1}{2} at^2$$

$$v^2 = u^2 + 2ad$$

$$v = \frac{\Delta d}{\Delta t}$$

$$p = mv$$

$$\Delta p = p_f - p_i$$

$$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$$

$$\tau = BANI \cos\theta$$

Energy and Mechanics

E_g = mgh

E = hf

W = Fd

$$E_k = \frac{1}{2} mv^2$$

F = k x

Circular Motion

$$T = \frac{1}{f}$$

$$a = \frac{v^2}{r}$$

$$F = \frac{mv^2}{r}$$

$$E_p = \frac{1}{2} k x^2$$

$$v = \frac{2\pi r}{T}$$

Electricity and Magnetism

$P = \frac{W}{t}$

$I = \frac{Q}{t}$

$V = \Delta E/q$

$V = IR$

$P = VI$

$B = \frac{kI}{d}$

$F = \frac{\mu_0 I_1 I_2 L}{2\pi d}$

$F = Bqv$

$F = k\frac{q_1 q_2}{r^2}$

$F = IBL$

$P = \Delta E/t$

$V = Bvl$

Light and Waves

$\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$ $\quad \frac{1}{f} = \frac{1}{u} + \frac{1}{v}$

$m = \frac{H_i}{H_o} = \frac{d_i}{d_o}$

$n_1 \sin\theta_1 = n_2 \sin\theta_2$

$d\sin\theta = n\lambda$

$d\sin\theta = (n - \frac{1}{2})\lambda$

$v = f\lambda$

Pressure

$PV = nRT$

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ = constant

STUDENT EDUCATION NUMBER									

SSLC PHYSICS

2025

(For Scorers only)

STRANDS		Weighting	Scores	Check Scorer	AED check
STRAND 1	ENERGY	25			
STRAND 2	ELECTRICITY	25			
STRAND 3	MAGNETISM	25			
STRAND 4	FORCES AND MOTION	25			
	TOTAL	**100**			