STUDENT EDUCATION NUMBER									

GOVERNMENT OF SAMOA
MINISTRY OF EDUCATION, SPORTS AND CULTURE

Samoa Secondary Leaving Certificate

PHYSICS

2020

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 space, ask the Supervisor for extra paper. Write your SEN on all extra sheets used and clearly number the questions. Attach the extra sheets at the appropriate places in this booklet.

NOTE: All required formulas are provided on the last page.

CURRICULUM STRANDS		Page	Time (min)	Weighting
STRAND 1:	MEASUREMENT	2	18	10
STRAND 2:	WAVES	4	32	18
STRAND 3:	MECHANICS	7	44	24
STRAND 4:	ELECTROMAGNETISM	11	50	28
STRAND 5:	NUCLEAR PHYSICS	15	18	10
STRAND 6:	ELECTRICITY	16	18	10
	TOTAL		**180**	**100**

Check that this booklet contains pages 2-19 in the correct order and that none of these pages are blank.

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

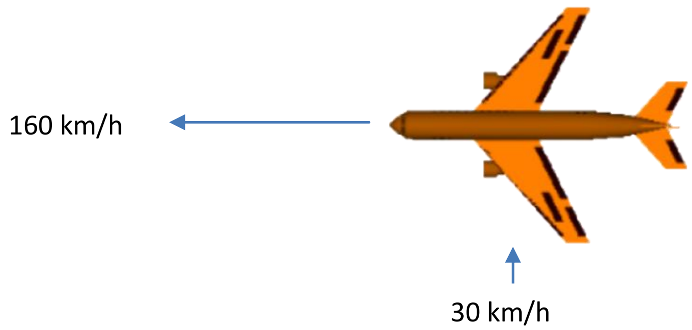
1. Express 25,234 kg in **scientific notation**.

SL 1

2. Express 25,234 kg in **3 significant figures** in the space provided.

SL 1

3. An airplane has a maximum velocity of 160 km/h in still air. Calculate its maximum velocity when it travels in air with a crosswind of 30 km/h.



SL 2

4. A ball is fired from a launcher with an initial velocity of 20.0 m/s at an angle of 30.0^0 to the horizontal. Calculate the horizontal and vertical initial velocity components.

SL 3

5. The table given below shows some of the data obtained from Question 4. Complete the table and use it to **sketch** a velocity-time graph of the ball.

Time (s)	Velocity (m/s)
0	20
0.5	15
1	
1.5	5
2	0
2.5	
3	
3.5	
4	-20

SL 3

6. Define **real image**.

SL 1

7. Name a property of a **convex mirror**.

SL 1

8. Define **partial reflection**.

SL 1

9. Give the definition for **refractive index**.

SL 1

10. Use Snell's law to determine the angle of refraction for light entering water at an incident angle of 30^0. The refractive index of water is 1.33.

SL 1

11. Define the **amplitude of a wave**.

SL 1

12. An electric generator can supply an AC power of 240V and 10A at a frequency of 50 Hz. Describe the concept of 50Hz frequency in this case.

SL 2

13. Describe the concept of **wavelength in light waves**.

SL 2

14. The average velocity of light in air is 300,000,000 m/s. Determine the frequency of light, if 700 nm wavelength was used in an experiment.

SL 3

15. Draw a diagram and use an example to discuss the **wave model of light**.

SL 4

16. Define **diffraction of waves**.

SL 1

17. Define **acceleration**.

SL 1

18. A ball is fired from a launcher with an initial velocity of 50.0 m/s at an angle of 30^0 to the horizontal. Calculate the horizontal distance travelled.

SL 4

19. Explain the relationship between the weight of an object and the gravitational field.

SL 4

20. State the **universal law of gravitation**.

SL 1

21. Describe the projectile motion of an object, which is under the influence of gravity. *(You may use a diagram to illustrate).*

SL 2

22. State **Newton's second law of motion**.

SL 1

23. State the formula for **centripetal force**.

SL 1

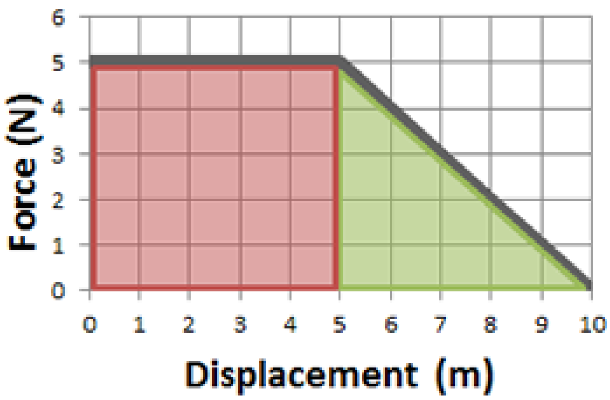
24. Explain the relationship between the area under a force-displacement graph and the amount of work done.

SL 3

25. State the formula for **calculating work done**.

SL 1

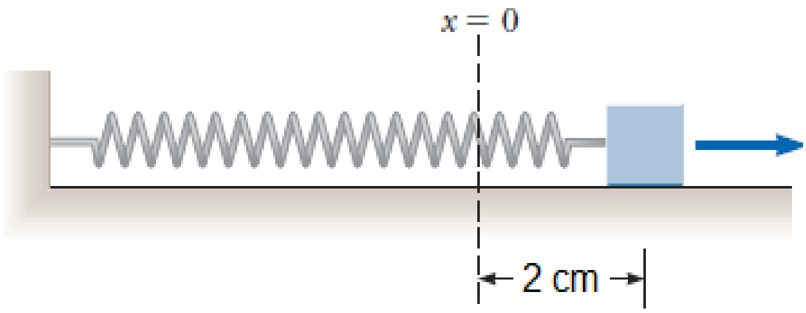
26.



Calculate the total work done. *(Use the above force-displacement graph)*.

SL 2

27. A light spring with a spring constant of 1000 N/m is extended 2 cm to the right. Calculate the spring potential energy stored.



SL 2

28. Describe how forces produce pressure in a container which contains gas.

SL 2

29. Calculate the magnitude of the magnetic force experienced on a moving electric wire conductor that carries 2A. The length of carrying wire conductor is 10 cm and it is moving across a magnetic field of 2T.

SL 4

30. State the qualities that make materials good or bad conductors.

SL 1

31. State the conditions that are necessary to induce a voltage in a straight conductor or a coil.

SL 1

32. A proton, which has a charge of 1.6×10^{-19} C, is moving at a velocity of 3,000 m/s towards the east through a magnetic field of strength 0.05 T directed south. What is the strength and direction of the magnetic force on the proton at this instant?
.

SL 4

33. Explain why commercial transformers cannot operate on direct current (dc) supply.

SL 3

34. Describe how electrons and not protons are the conveyors (carriers) of charge in an electric wire conductor. *(You may use a diagram to illustrate your answer).*

SL 2

35. List the materials and apparatus required for a magnetic field investigation.

SL 2

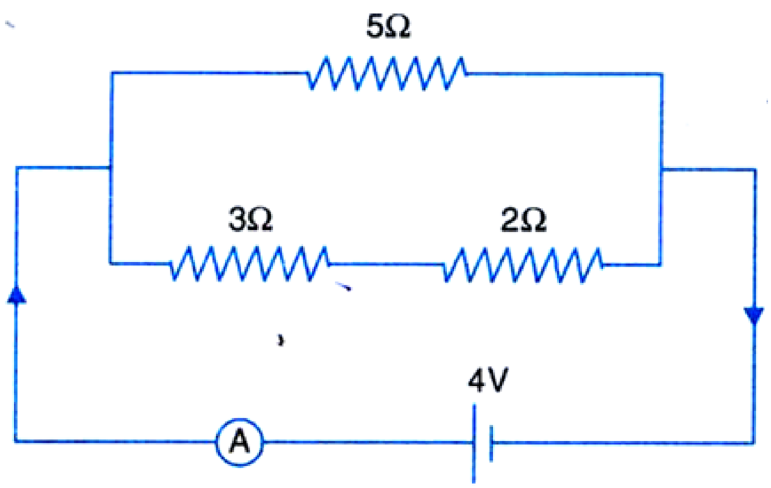
36. The Homebase electrical information is given in the label above. Explain the power rating of this electrical appliance.

SL 2

37. Calculate the electrical power produced by an electrical resistance of 10 ohms if a current of 2 A flows through it.

SL 2

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



SL 2

39. Determine the potential difference across the 3 ohm resistor.

SL 2

40. Calculate the heat dissipated by the 2 ohm resistor.

SL 3

STRAND 5:	NUCLEAR PHYSICS	Weighting 10

41. What causes the deflection of alpha particles in Rutherford's experiment?

SL 3

42. State ONE feature of **Thompson's model of the atom**.

SL 1

43. Define the concept of **half-life in radioactive elements**.

SL 1

44. Describe the **photoelectric effect in metals**.

SL 2

45. Describe ways in which atomic radiation can be valuable to humans.

SL 3

46. Draw a diagram to illustrate and explain in details how a moving loud speaker operates.

SL 3

47 Describe the production of a current through electromagnetic induction.

SL 2

48 Describe applications of electrostatics.

SL 2

49. Explain how an electroscope is used to identify whether an object is a conductor or an insulator.

SL 3

PHYSICS EQUATIONS SHEET

Kinematics

v = u + at

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

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

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

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

mass of the proton = 1.67×10^{-27} kg

Momentum

$p = mv$

$\Delta p = p_f - p_i$

$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

$\tau = BANI\cos\theta$

Light and Waves

$\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$

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

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

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

$v = f\lambda$ $E_k = \frac{1}{2}mv^2$

Circular Motion

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

$F = \frac{mv^2}{r}$ $E_p = \frac{1}{2}kx^2$

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

Electricity and Magnetism

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

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

V = ΔE/q

V = IR

P = VI

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

F = Bqv

F= IBL

P = ΔE/ t

V = Bvl

Energy and Mechanics

W = Fd

E = mgh

F = k x

List of constants

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

$k = 2 \times 10^{-7} NA^{-2}$

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

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

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

h = 6.6 x 10^{-34} Js

E = hf

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(For Scorers only)

CURRICULUM STRANDS	Weighting	Scores	Chief Scorer	Double Entry (AED)
STRAND 1: MEASURMENT	10			
STRAND 2: WAVES	18			
STRAND 3: MECHANICS	24			
STRAND 4: ELECTROMAGNETISM	28			
STRAND 5: NUCLEAR PHYSICS	10			
STRAND 6: ELECTRICITY	10			
TOTAL	**100**			