STUDENT EDUCATION NUMBER									

GOVERNMENT OF SAMOA
MINISTRY OF EDUCATION, SPORTS AND CULTURE

Samoa Secondary Leaving Certificate

PHYSICS

2019

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	3	32	18
STRAND 3:	MECHANICS	6	44	24
STRAND 4:	ELECTROMAGNETISM	10	50	28
STRAND 5:	NUCLEAR PHYSICS	14	18	10
STRAND 6:	ELECTRICITY	15	18	10
TOTAL			**180**	**100**

Check that this booklet contains pages 2-18 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: **MEASUREMENT** **Weighting 10**

1. Express 0.021609 metres in scientific notation.

SL 1

2. Express the answer from Number 1 into 3 significant figures.

SL 1

3. Toma walked 250 metres to the north and then walked 175 metres to the east. **Determine** his total displacement.

SL 2

4. A Manu Samoa rugby player placed a drop-kick toward the goal post at an angle of 60^{o} above the horizontal plane. The velocity of the rugby ball is 20 m/s. Determine the horizontal and the vertical velocity components of the rugby ball.

SL 3

5. Explain clearly the importance of the direction of a vector.

SL 3

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STRAND 2: WAVES Weighting 18

6. Describe how a light ray behaves when it travels from glass to air.

SL 1

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7. Which of the three aspects of light – velocity, frequency and wavelength, remains unchanged during refraction?

SL 1

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8. Partial reflections always occur in light refraction. What is partial reflection?

SL 1

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9. Give the definition for refractive index.

SL 1

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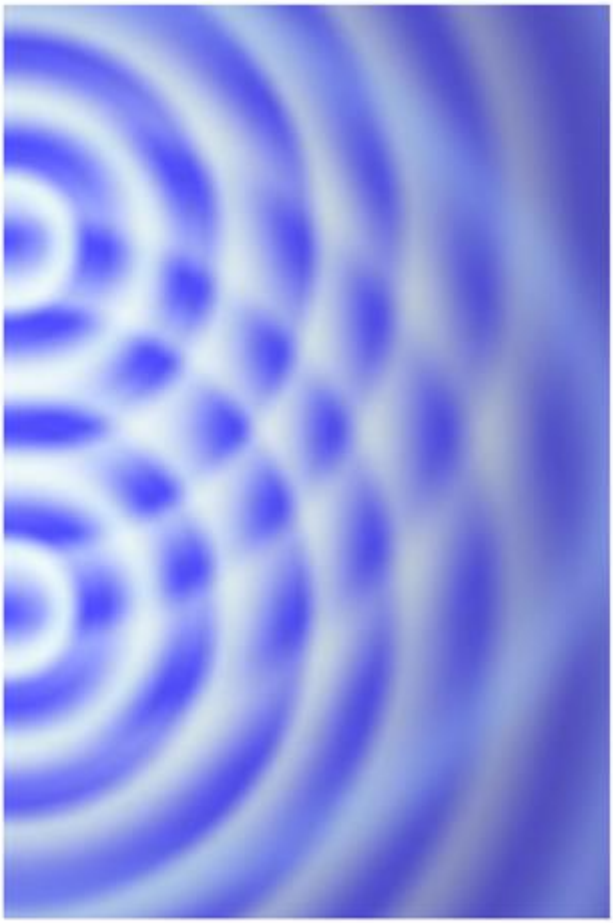
The diagram below shows an interference pattern from a wave experiment.



10. Label on the diagram the two sources, S_1 and S_2 which are the origins of the waves.

SL 1

11. On the same diagram, draw a line that represents waves that are in phase.

SL 1

12. What is the name of the line you have just drawn in Number 10?

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SL 2

Marked the central maximum of the interference pattern on the diagram.

13. Explain the concept of wavelength.

SL 2

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14. In longitudinal wave, explain how energy is transferred from one point to another. Give an example and draw a diagram to illustrate the transfer of energy.

SL 3

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15. Discuss weaknesses of the corpuscular light model.

SL 4

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16. Name ONE nature of the image formed from a convex mirror.

SL 1

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17. The value of gravitational acceleration in projectile motion is 10 m/s^2. Define acceleration.

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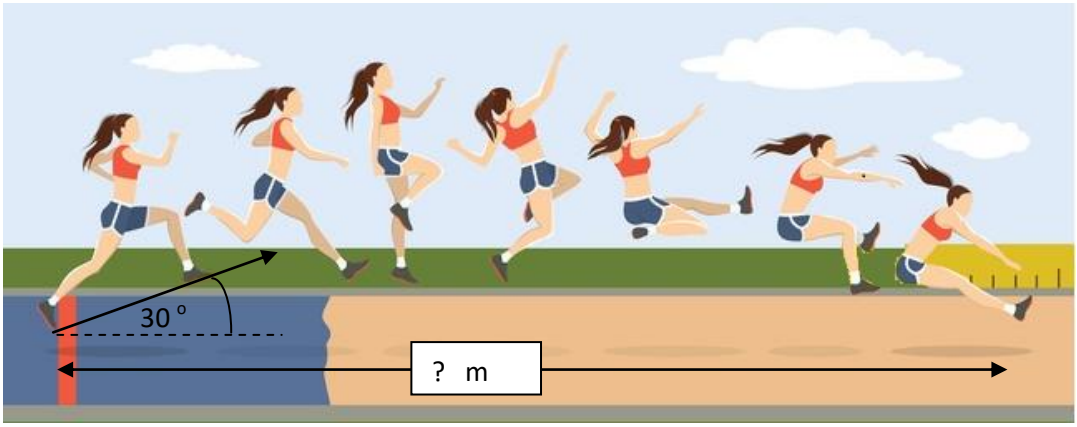
SL 1



18. A long jumper leaves the ground at the angle of 30.0^o above the horizontal and at a speed of 11.0 m/s.

How far would she jump in the horizontal direction?
(Express your answer in metres).

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SL 4

During the flight, the long jumper reaches the maximum height at halfway of the horizontal distance. Calculate the maximum height reached by the long jumper.

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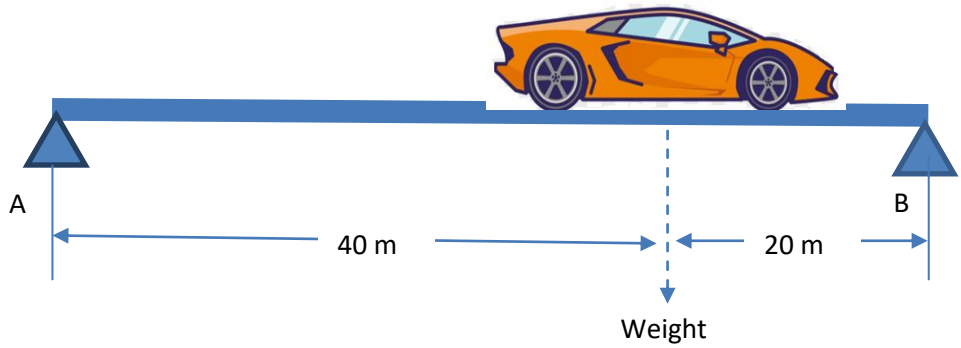
The diagram shows a car on a bridge.



19. The mass of the car is 2000 kg. Calculate its weight in newtons.

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By taking moments about pivot A, find the increase in the upward force provided by support B when the car is on the bridge in the position shown.

SL 4

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20. State the universal law of gravitation.

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SL 1

21. Objects with masses of 200 kg and 500 kg are separated by a distance of 0.400 m. Find the gravitational force between the two masses.

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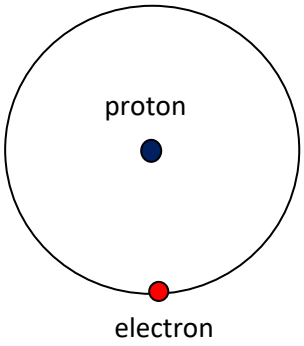
SL 2

22. A model of a hydrogen model is given in the diagram below. Draw the direction of the centripetal force experienced by the electron as it revolves around the proton.



SL 1

23. State the formula for centripetal force.

SL 1

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24. Find the centripetal acceleration of the electron, if the radius of the circular orbit is 0.529×10^{-10} m and the speed of the electron is 2.2×10^{6} m/s.

SL 3

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25. State the formula for calculating work done.

SL 1

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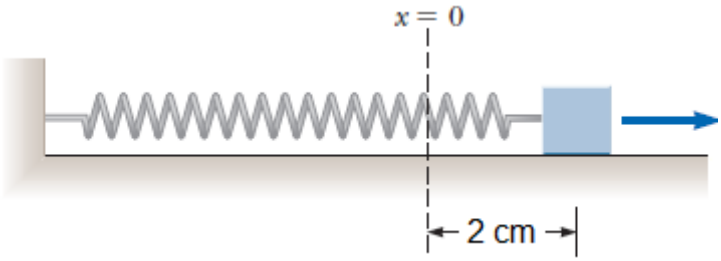
26. A man cleaning a floor pulls a vacuum cleaner with a force of magnitude, F = 100.0 N at an angle of 30^{o} above the horizontal.

Calculate the horizontal component of the force acting on the vacuum cleaner.

SL 2

27. A light spring in the diagram below is extended 2.00 cm to the right by a force of 10 N. Calculate the spring constant of the spring.

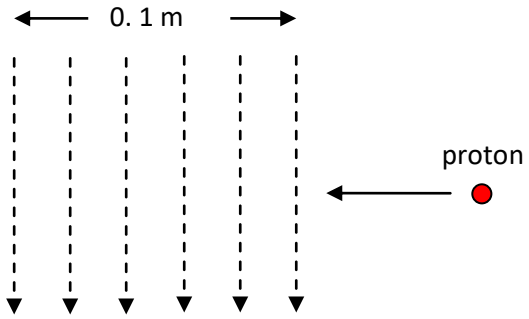


SL 2

28. Calculate the energy stored in the spring that is extended 2.00 cm.

SL 2

29. A proton moves at 2.2 x 10^6 m/s in the horizontal direction. It enters a region where the electric field is 9.60 x 10^3 N. *(Ignore the gravitational effect).*



Calculate the time interval for the proton to travel 0.1 m across.

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SL 4

Find the acceleration of the proton in this region.

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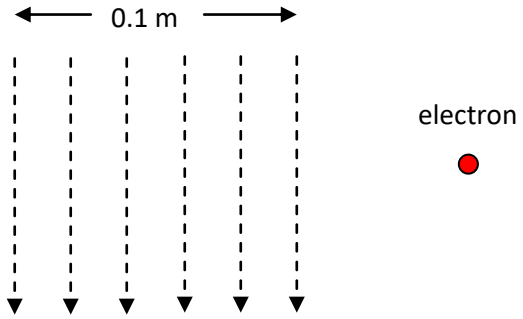
30. Draw the path of the motion of the proton while moving through the electric field using the diagram in page 10.

SL 1

31. Sketch in the diagram below, the pathway motion of the electron if the proton is replaced with an electron in diagram page 10.



SL 1

32. If the electric field in Number 32 is now replaced with a magnetic field with a strength of 0.025 T, calculate the magnitude of the magnetic force exerted on the moving electron. *(The velocity of the electron is the same as the proton in Number 30).*

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SL 4

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33. An electric wire 20 cm long carries a current of 3 A at right angles to a magnetic field. The wire has a force of 3 N exerted on it. Calculate the strength of the magnetic field.

SL 3

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

SL 2

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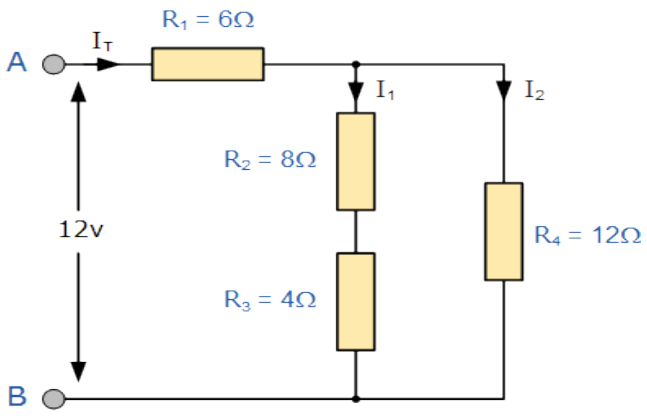
Use diagram below to answer Numbers 35 – 40.

35. Calculate the combined resistance of R_2, R_3 and R_4 in the circuit shown in the diagram below.

SL 2



36. Calculate the total resistance of the circuit.

SL 2

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37. What is the difference between voltage and current?

SL 2

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38. Calculate the total current, I_T as shown in the circuit.

SL 2

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39. Determine the potential difference across R_1.

SL 2

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40. Calculate the current I_1 and I_2 in the electric circuit.

SL 3

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

SL 3

42. State ONE difference between Thompson's and Rutherford's model of the atom.

SL 1

43. Define the term **photon**.

SL 1

44. What is photoelectric effect?

SL 2

45. Explain why radiation from radioactive material is dangerous to human beings.

SL 3

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STRAND 6: ELECTRICITY Weighting 10

46. Draw a diagram to illustrate and explain in details how a simple DC motor operates.

SL 3

47 Describe the difference between the flows of conventional current and the direction of the actual flow of electrons in electricity.

SL 2

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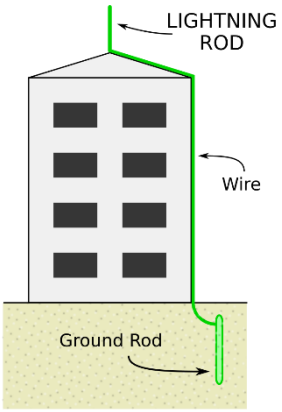
48 Explain how a lightning rod installed at the top of tall buildings reduces lightning strike.



SL 2

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49. Using the picture below, explain how the plastic comb becomes electrically charged.

SL 3

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PHYSICS EQUATIONS SHEET

Kinematics

v = u + at

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

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

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

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

Electricity and Magnetism

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

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

V = ΔE/q

V = IR

P = VI

List of constants

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

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

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

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

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

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

Momentum

$p = mv$

$\Delta p = p_f - p_i$

$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

$\tau = BANI\cos\theta$

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

h = 6.6 x 10^{-34} Js

F = Bqv

Light and Waves

P = ΔE/ t

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

V = Bvl

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

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

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

$v = f\lambda$

Energy and Mechanics

W = Fd

E = mgh

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

E = hf

Circular Motion

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

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

F = k x

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

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

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PHYSICS

2019

(For Scorers only)

CURRICULUM STRANDS	Weighting	Scores	Chief Scorer
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**		