| STUDENT EDUCATION NUMBER | | | | | | | | | |
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GOVERNMENT OF SAMOA
MINISTRY OF EDUCATION, SPORTS AND CULTURE

# Samoa Secondary Leaving Certificate

# PHYSICS

# 2018

## 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 left 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 | 14 | 50 | 28 |
| **STRAND 5:** | NUCLEAR PHYSICS | 21 | 18 | 10 |
| **STRAND 6:** | ELECTRICITY | 22 | 18 | 10 |
| **TOTAL** | | | **180** | **100** |

Check that this booklet contains pages 2-26 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.** One of the non SI units for distance that is still used today in some parts of the world is known as “mile”. One mile is equivalent to 1,609 metres.

Express 1,609 metres in scientific notation.

| SL 1 |
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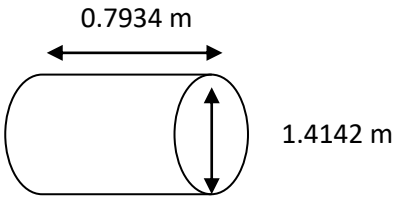
**2.** A student’s calculation on the volume of the cylindrical given below is 4,984983609 $m^2$.




Express the student’s final answer into 2 significant figures.

| SL 1 |
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**3.** A novice pilot sets a plane’s controls, thinking the plane will fly at 250 km/h to the north. Calculate the resultant velocity of the plane if the wind blows 75 km/h toward south east.

| SL 2 |
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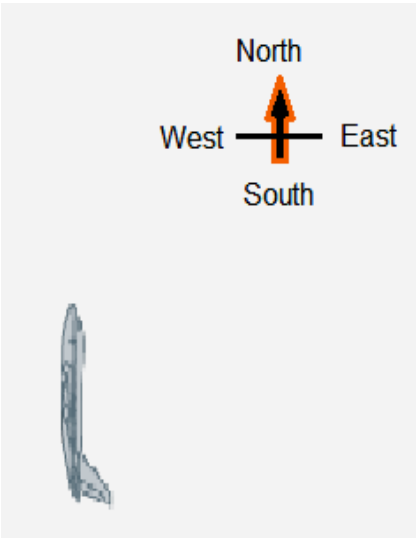

**4.** A Manu Samoa rugby player placed a drop-kick toward the goal post at an angle of $30^{o}$ above the horizontal? Determine the horizontal and the vertical component velocity of the rugby ball, if its initial velocity is 30 m/s.

| SL 3 |
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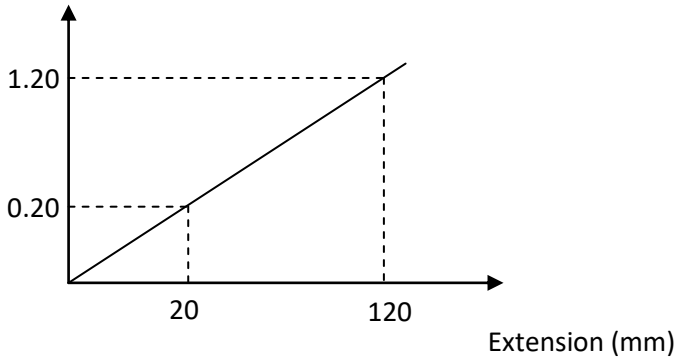
The graph given below is the sketch of the spring extensions under different weights. The slope of the graph represents the value of the spring constant of the spring.

**5.** What is the value of the spring constant of the spring in Newton/meter?




| SL 3 |
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**6.** Describe how a light ray behaves when it enters an optically denser material.

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| SL 1 |
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**7.** If a light ray consists of red, green and violet, state ONE feature of refraction in different colours.

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| SL 1 |
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**8.** Define partial reflection.

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| SL 1 |
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**9.** Give the definition for refractive index.

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| SL 1 |
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**10.** In Young's experiment, the bright fringes formed on the screen are light waves that are in phase. Define the term "In-Phase."

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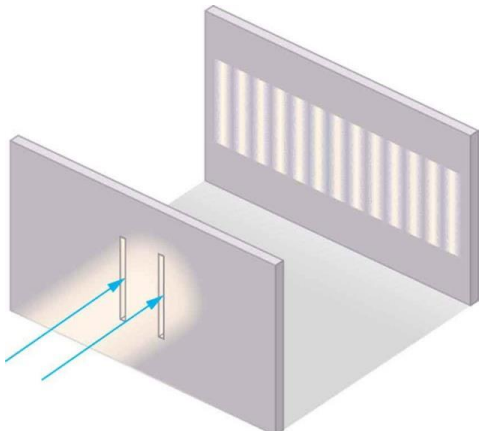

| SL 1 |
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**11.** In Young's experiment, some fringes indicate light waves are out of phase. Define the term "Out-of-Phase."

| SL 1 |
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**12.** Describe the concept of 'frequency of wave.'

| SL 2 |
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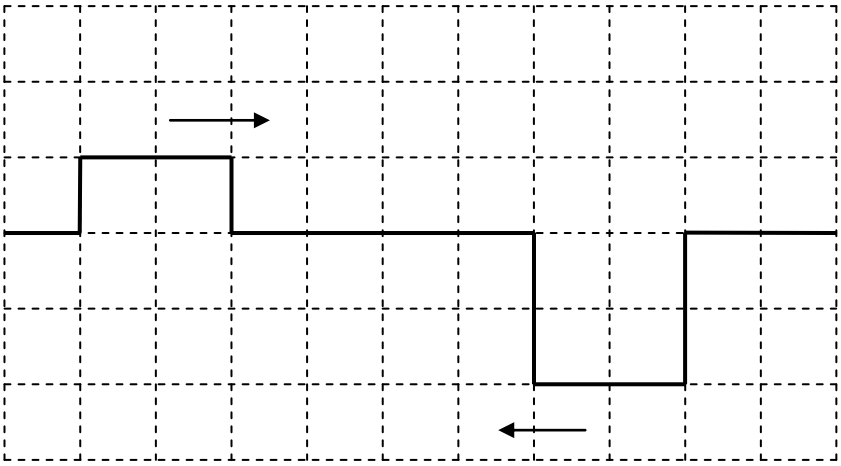
The diagram given below is a snapshot taken from a Cathode Ray Oscilloscope (CRO) display. Two square waves with the same speeds and different sizes are travelling in opposite directions.



**13.** Use the grid given below to draw the resultant wave at time, t = 3 seconds. (Assume that the speed of the waves is 1 cm/s and the snapshot of the CRO display on page 5 was taken at time, t = 0 second).

| SL 2 |
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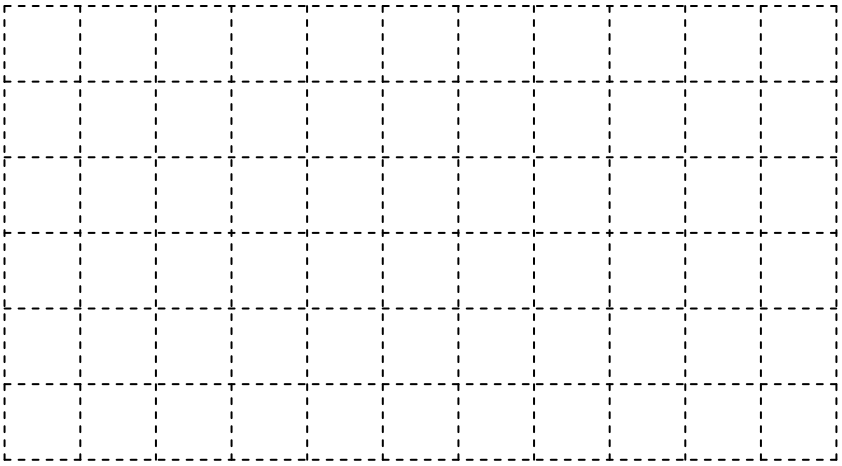

**14.** Explain why the wave front of a water wave is always perpendicular to the direction of travel. (You may use a diagram to illustrate).

| SL 2 |
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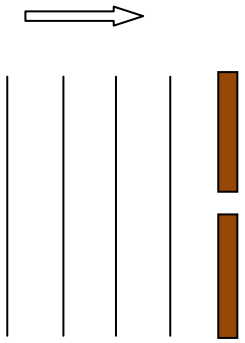
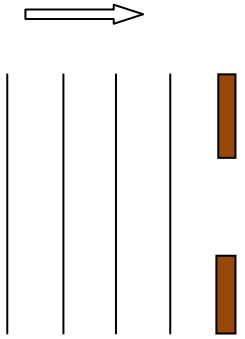
**15.** Straight water waves were generated and travelled to the right in a ripple tank. Two different sizes of apertures were used to study the diffraction of waves. The first setup used a size less than the wavelength of the waves and the second setup used a size more than the wavelength of the waves.

(i) On the diagrams given below of the first and the second setups, draw how the water waves diffract after they pass through the apertures.

First Setup:



Second Setup:



(ii) Discuss how the size of the aperture relative to the wavelength affects the transmission of water waves through a barrier.

| SL 4 |
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**16.** Name ONE property of a convex mirror.

| SL 1 |
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**STRAND 3:** **MECHANICS** **Weighting 24**

**17.** State the value of gravitational acceleration in projectile motion.

| SL 1 |
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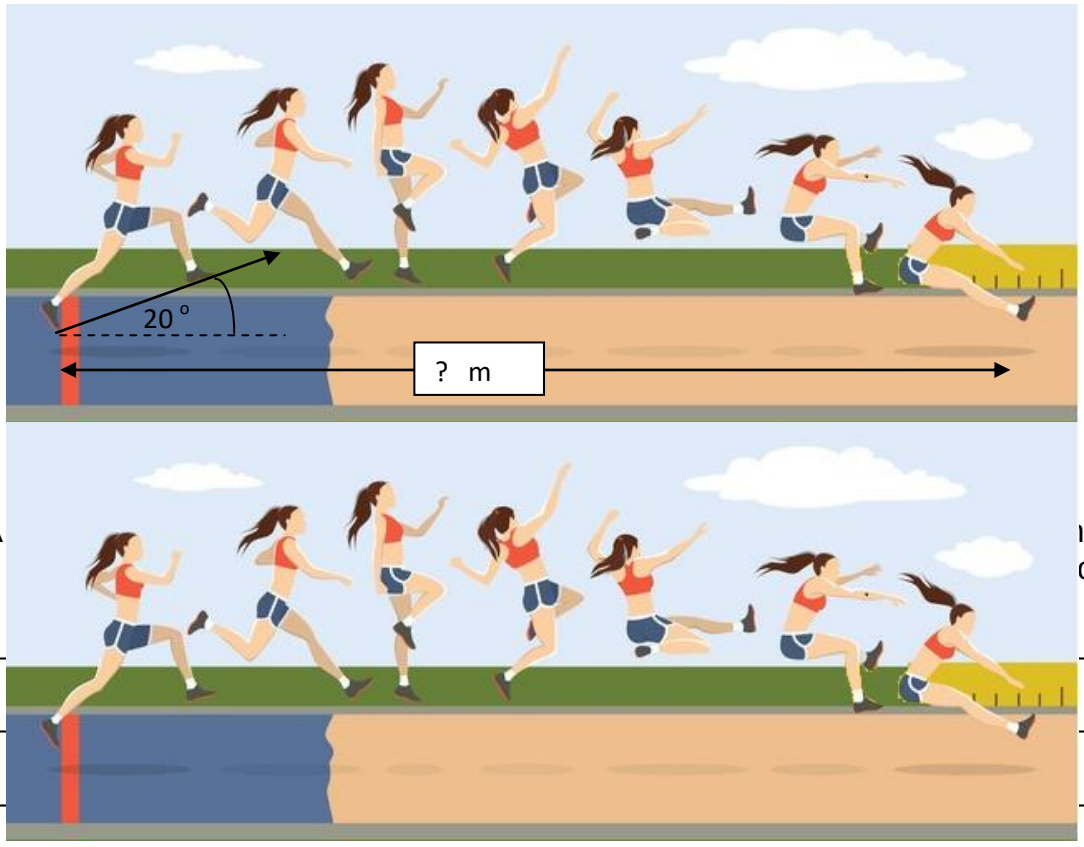


**18.** A ...nd at a ...on?

| SL 4 |
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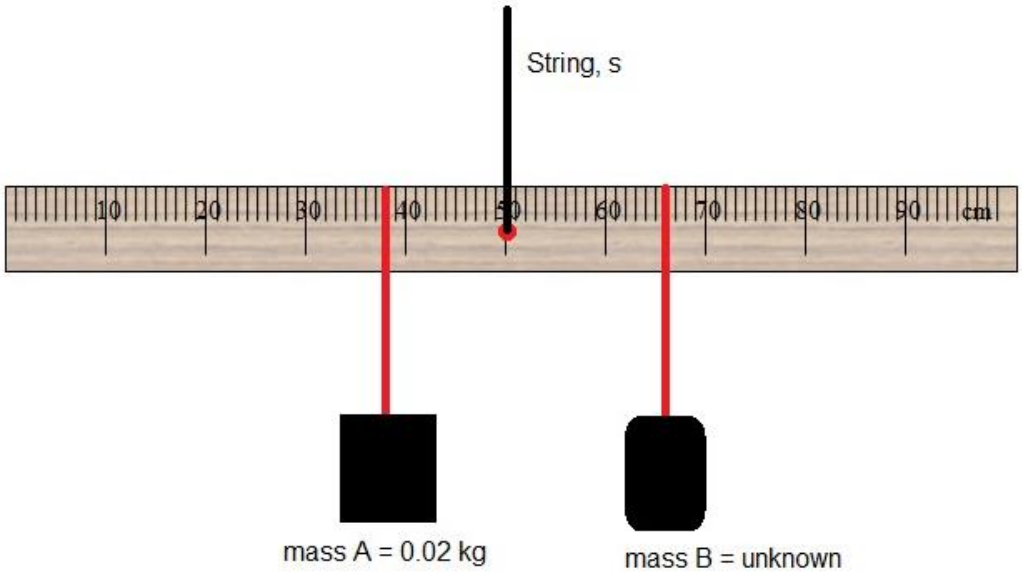
A year 13 Physics student carried out an experiment to study the concept of equilibrium. He used a metre ruler, which was supported and balanced by a string, s, at 50 cm. Two masses, A and B, were balanced by sliding the masses at different distances along the ruler. Mass A is 0.02 kg and mass B is unknown. The table given below is the five trials.




| Trial | Position of mass A on the ruler | Position of mass B on the ruler |
|---|---|---|
| 1 | 38 cm | 66 cm |
| 2 | 32 cm | 74 cm |
| 3 | 26 cm | 82 cm |
| 4 | 20 cm | 90 cm |
| 5 | 14 cm | 98 cm |

**19.** (i) To help the student analyse his result, he drew another table but spillage from a cup of coffee smudged the results and only 4 could be read. You are to help the student by filling in the appropriate values in the clean table provided.

| SL 4 |
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| Trial | Effective distance for mass A (cm) | Effective distance for mass B (cm) |
|---|---|---|
| 1 | 12 | |
| 2 | | 24 |
| 3 | 24 | |
| 4 | | |
| 5 | | 48 |

Fill in the correct values.

| Trial | Effective distance for mass A (cm) | Effective distance for mass B (cm) |
|---|---|---|
| 1 | 12 | |
| 2 | | 24 |
| 3 | 24 | |
| 4 | | |
| 5 | | 48 |

(ii) Determine the unknown mass B.

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**20.** Name ONE application of circular motion.

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| SL 1 |
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**21.** State the formula for centripetal acceleration.

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| SL 1 |
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**22.** State the formula for centripetal force.

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| SL 1 |
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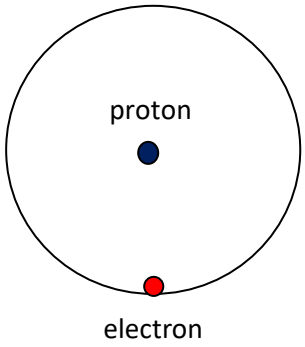
**23.** An electron moves in a clockwise circular path around a proton.
The speed of the electron is about $2.20 \times 10^{6}$ m/s.

On the diagram, draw the direction of the velocity vector of the electron.




| SL 1 |
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**24.** Find the centripetal acceleration of the electron, if the radius of the circular orbit is $0.529 \times 10^{-10}$ m.

| SL 3 |
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**25.** State the formula for calculating the work done.

| SL 1 |
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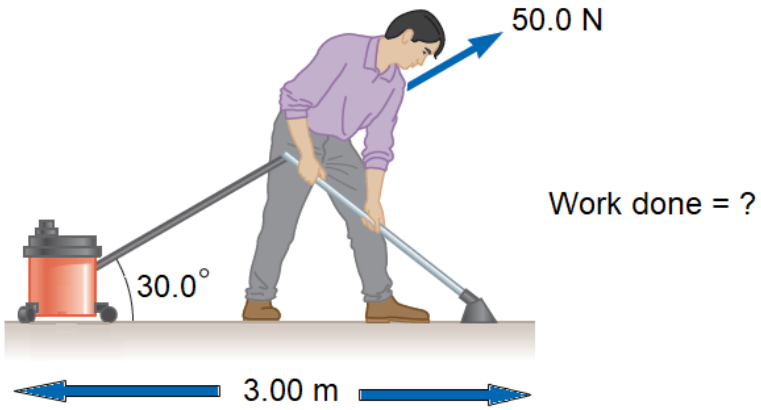
A man cleaning a floor pulls a vacuum cleaner with a force of magnitude, F = 50.0 N at an angle of $30^{o}$ to the horizontal.




**26.** Calculate the work done by the force on the vacuum cleaner as the vacuum cleaner is displaced 3.00 m to the right.

| SL 2 |
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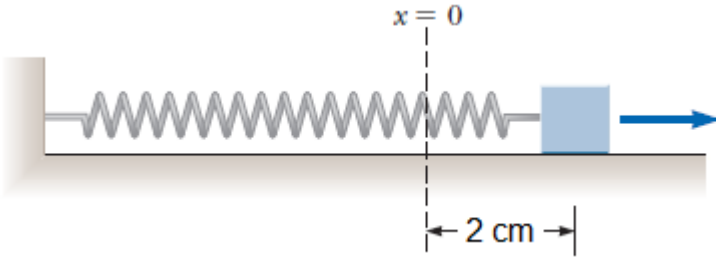
A light spring with force constant 4 N/m is extended by 2.00 cm.




**26.** Calculate the stored energy in the spring.

| SL 2 |
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A Bus and a SUV vehicle are moving at the same velocity along a straight road. However, the two vehicles do not have the same momentum.

**27.** Define the momentum of the moving vehicles.

| SL 1 |
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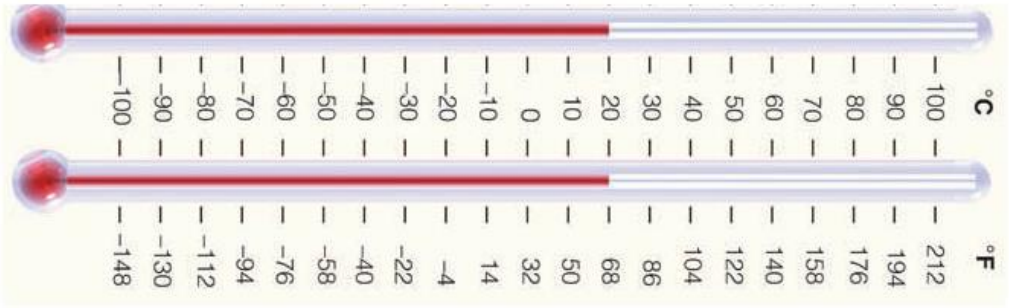
Different countries use different temperature scales, Celcius or Fahrenheit, when measuring the temperature of the local weather.




**28.** What is the definition of temperature?

| SL 1 |
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**29.** Convert 25$^{o}$C into the Kelvin scale.

| SL 1 |
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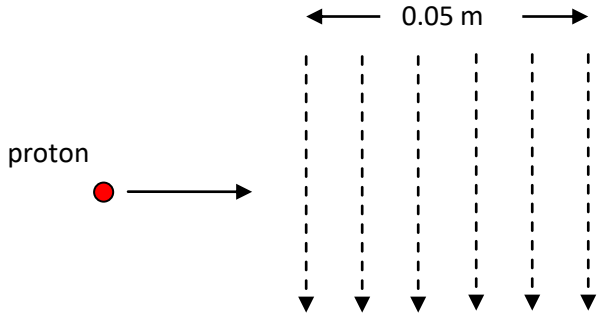
**30.** A proton whose mass is 1.67 x $10^{-27}$ kg with a charge of 1.6 x $10^{-19}$C moves at 4.5 x 105 m/s in the horizontal direction. It enters an electric field of 9.60 x $10^{3}$ N/C. (Ignore the gravitational effect).




(i) Calculate the time interval for the proton to travel 0.05 m across.

SL 4

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(ii) Determine the <u>magnitude and direction of acceleration</u> of the proton in this region. (Ignore the gravitational effect).

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**31.** Draw in the diagram in Number 30 on page 14 the path of the motion of the proton during the 0.05 m distance.

| SL 1 |
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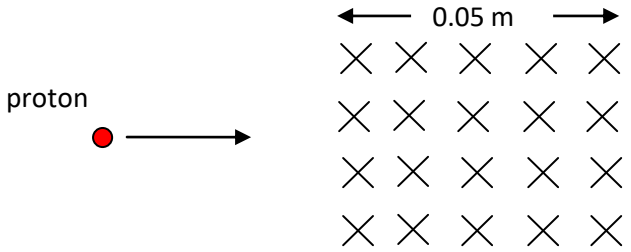
**32.** If the region, 0.05 m is replaced with a magnetic field and is going through the page. Sketch in the diagram how the proton moves in this region.




| SL 1 |
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**33.** If the strength of the magnetic field in Number 32 is 0.025 T, calculate the magnitude of the magnetic force exerted on the moving proton.

| SL 4 |
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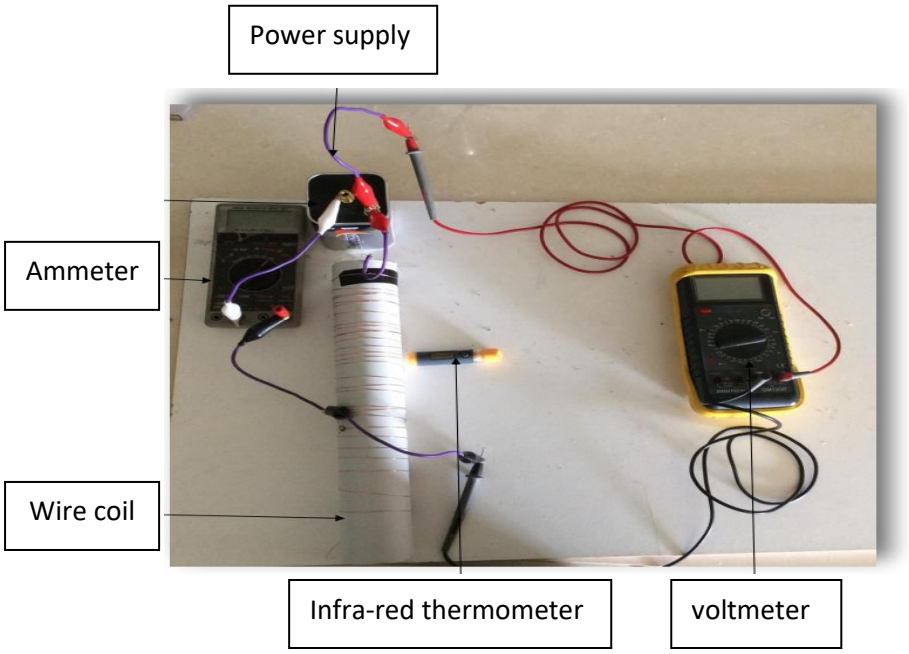
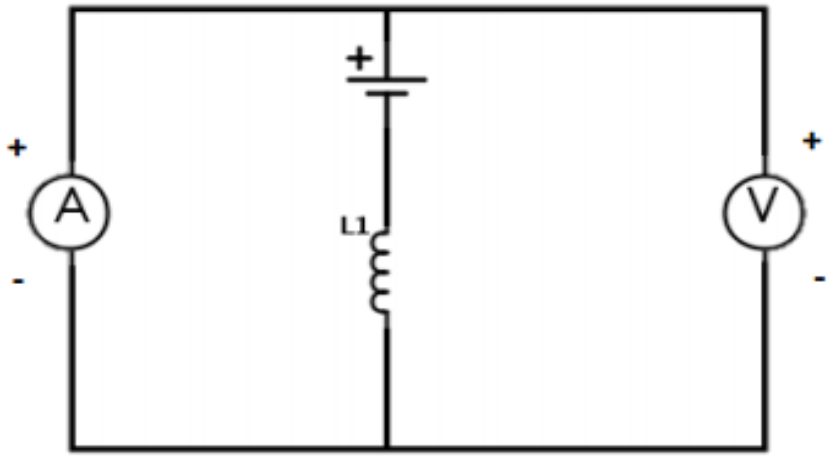
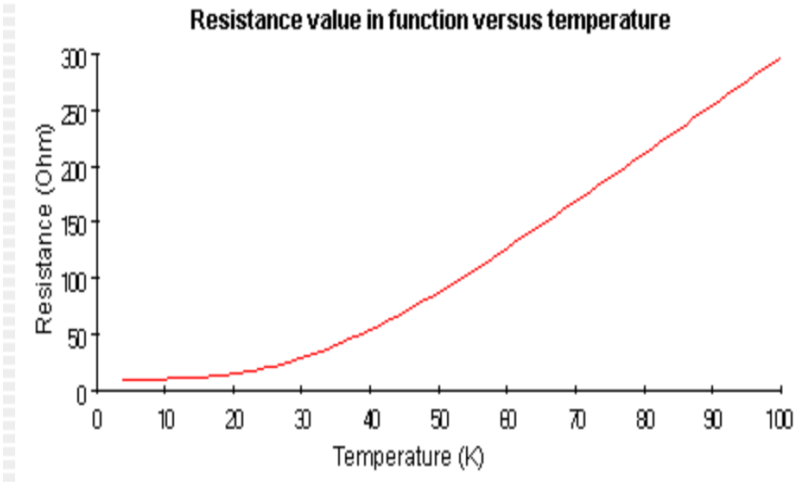



A long piece of wire was used to investigate the effect of the temperature versus the resistance of the wire. The wire is wound around a PVC pipe and an infra-red thermometer was used to take the temperature of the wire as the electrical power increased. The schematic circuit diagram is given below.



The plot of the results of the experiment is given below. It shows how resistance of the wire varies at different temperatures.




**34.** (i) If the resistance of the wire at $5^{o}C$ is 10 ohms, what is its resistance at $10^{o}C$?

SL 3

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(ii) From the graph, explain how the resistance of the wire varies with regard to temperatures.

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**35.** 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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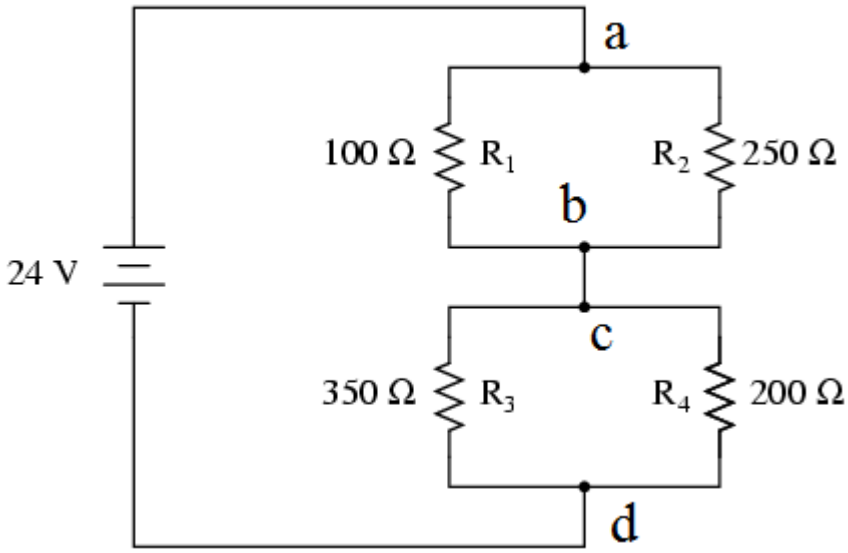
**36.** Calculate the total resistance of the circuit given below.




| SL 2 |
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**37.** Calculate the potential difference between points ‘a’ and ‘b’, and points ‘c’ and ‘d’.

(i) ‘a’ and ‘b’:

| SL 2 |
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(ii) ‘c’ and ‘d’:

**38.** Potential difference is also known as Voltage. Define voltage.

| SL 1 |
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**39.** Define electric current.

| SL 1 |
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**40.** The unit of electric charge is found in both voltage and current.
State the unit of charge.

| SL 1 |
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**41.** Refer to the diagram in Number 36. Determine the amount of heat dissipated from the circuit, if the circuit is turned on for one hour.

| SL 3 |
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**42.** Express 50 microvolts into millivolts.

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| SL 1 |
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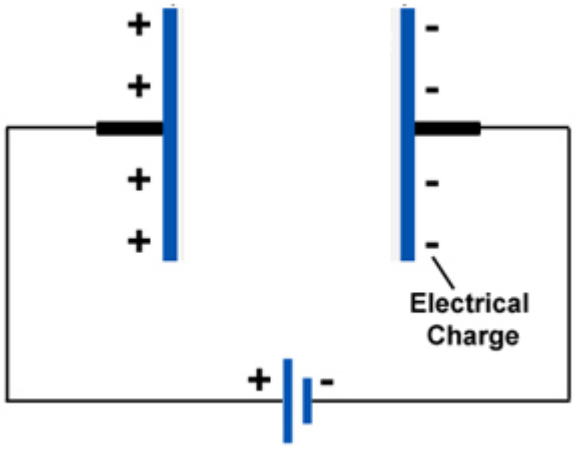
**43.** Draw the direction of electric field lines between two parallel plates that are opposite charged.




| SL 1 |
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**44.** Draw the electric field lines between two like charges.

| SL 1 |
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**45.** Explain how an alpha decay gives rise to a helium nucleus. (You may use one example).

SL 3

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**46.** Carbon dating uses Carbon -14, which has a half life of 5,730 years.
What does it mean by “half-life” in this sense?

SL 1

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**47.** The Iodide-131 sample has a half life of 8 days. If the sample starts at 1000 units, how many are left in the sample after 16 days. (show your working out).

SL 3

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**48.** Iodide-131 decays to xenon-131 and emits a beta particle.
Write the equation of this nuclear reaction.

SL 2

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**49.** Define the term ‘isotopes.’

| SL 1 |
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## STRAND 6: ELECTRICITY Weighting 10

**50.** Give the electrical symbols for the following components.

| SL 1 |
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(i) Light bulb _____

(ii) Variable Resistor _____

**51.** Describe the process of electrolysis. (You may use an example).

| SL 2 |
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**52.** Describe the difference between a primary cell and a secondary cell.

| SL 3 |
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**53.** Every electrical circuit has electrical resistance. Define the term resistance.

| SL 1 |
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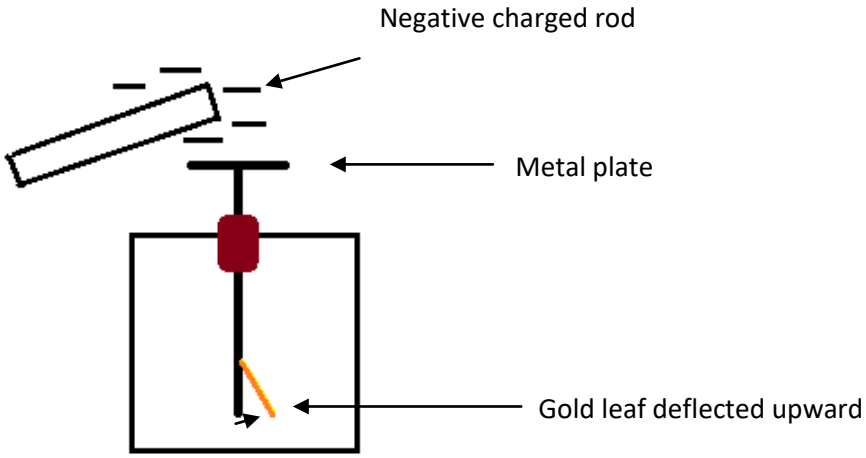
Two electroscopes A & B were used in an experiment. Electroscope A was neutral and Electroscope B was charged. A negatively charged rod was brought closer to the top metal plate of a neutral electroscope A and the gold leaf deflected upward.




**54.** (i) What kind of charges induced on the metal plate of the electroscope?

| SL 3 |
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(ii) If a piece of fur was used to charge the negative rod in the previous Number 54(i), what is the charge on the fur?

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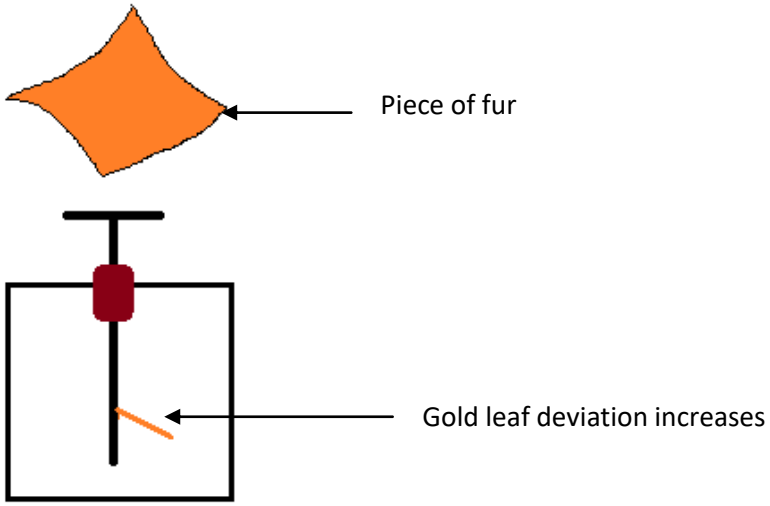
The piece of fur that was used in Number 54(ii) was then brought near the top of electroscope B, which has already being charged. The deflection of the gold leaf increases.




(iii) What is the charge of the electroscope?

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# PHYSICS EQUATIONS SHEET

## Kinematics

v = u + at

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

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

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

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

## 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

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

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

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

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

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

## Electricity and Magnetism

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

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

V = ΔE/q

V = IR

P = VI

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

F = Bqv

P = ΔE/ t

V = Bvl

## Energy and Mechanics

W = Fd

E = mgh

E = hf

## 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

| STUDENT EDUCATION NUMBER | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
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# PHYSICS

2018

(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** | | |