STUDENT EDUCATION NUMBER									

GOVERNMENT OF SAMOA
MINISTRY OF EDUCATION, SPORTS AND CULTURE

Samoa School Certificate

PHYSICS

2017

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	20	11
STRAND 2:	MECHANICS	4	41	23
STRAND 3:	HEAT	9	24	13
STRAND 4:	MAGNETISM	12	27	15
STRAND 5:	ELECTRICITY	14	34	19
STRAND 6:	WAVES	19	34	19
TOTAL			**180**	**100**

Check that this booklet contains pages 2-23 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. (a) Given below are FIVE pencils.

(i) Use a ruler to measure the length of each pencil in millimeters; and

SL 3

(ii) Present them in a table.

SL 3

(b) If you are to use a vernier caliper to measure the length of the pencils, **state** the expected outcome(s).

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SL 1

(c) Write a relevant title for the task you did in 1(a).

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SL 1

(d) Calculate the average length of the pencils in **millimeters** in the activity you did in 1(a).

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SL 2

(e) Express your answer in 1(d) in **metres** (m).

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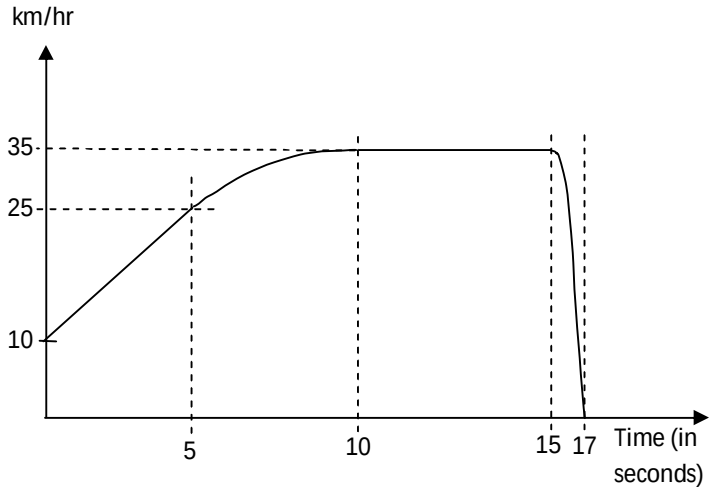
SL 1

2. (a) The diagram below represents the motion of a car.
(The diagram is not to scale).



Using the information in the graph, describe the motion of the car during the following times: 0 to 5 seconds, 10 to 15 seconds and 15 – 17 seconds.

(i) *0 – 5 seconds*

SL 3

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(ii) *10 – 15 seconds*

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(iii) *15 – 17 seconds*

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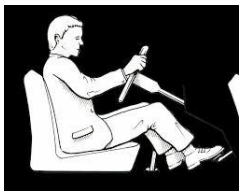
(iv) The brake was suddenly applied until the vehicle came to a stop.



How long did it take for the vehicle to come to rest when the driver applied the brakes:

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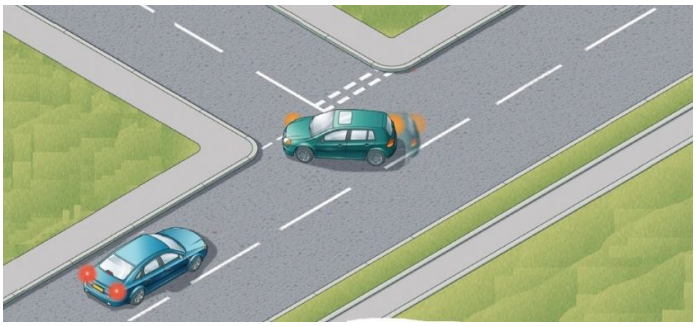
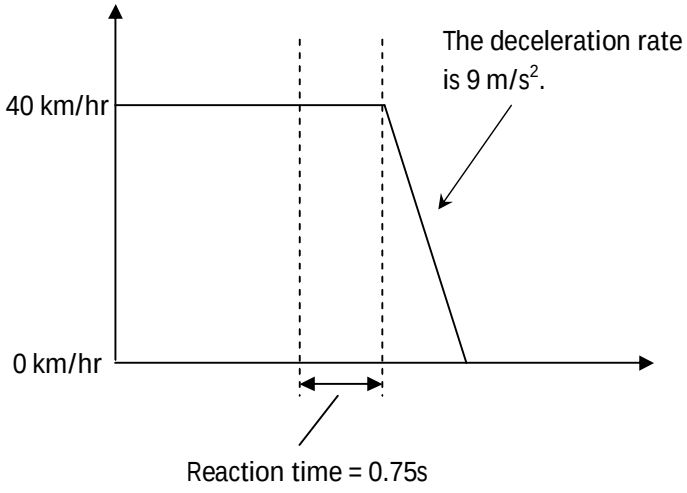
(b) Imagine you are cruising at a speed of 40 km/hr on the main road. All of a sudden an oncoming car on the right lane turns left and tries to get off the main road, but it stops 20 metres in front of you.



Determine whether you are going to hit the car or not. (Assume that your reaction time is 0.75s and the deceleration rate is 9m/s^2, once the brakes engage).

A sketch of the velocity-time graph is given below to help you solve the problem.



SL 4

(c) Explain how the energy associated with the moving car is converted into other forms of energy, when you apply the brakes.

SL 2

(d) Define the following terms:

(i) *Displacement*

SL 1

(ii) *Velocity*

SL 1

(iii) *Acceleration*

SL 1

(iv) *Pressure*

_____ SL 1

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(v) *Density*

_____ SL 1

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(vi) *Efficiency*

_____ SL 1

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(vii) *Moments*

_____ SL 1

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(viii) *Potential Energy*

_____ SL 1

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(e) A motor bike accelerates from rest at a rate of $2m/s^2$ and reaches a final speed of 10m/s. Show that the average velocity of the motor bike is 5 m/s.

_____ SL 2

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(f) State the principle of Energy of Conservation.

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SL 1

(g) A box with a mass of 50 kg is needed to be placed on the truck. One option is to push it along a ramp of 5 metres in length as in diagram 1. The other option is to lift it straight up on the truck as in diagram 2.

Diagram 1

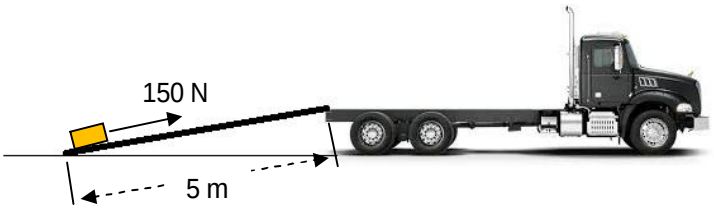

Diagram 2

The <u>work required</u> in moving the box onto the truck is the same for both options. However, the <u>effort required</u> to move the box for each option are not the same. Explain why.

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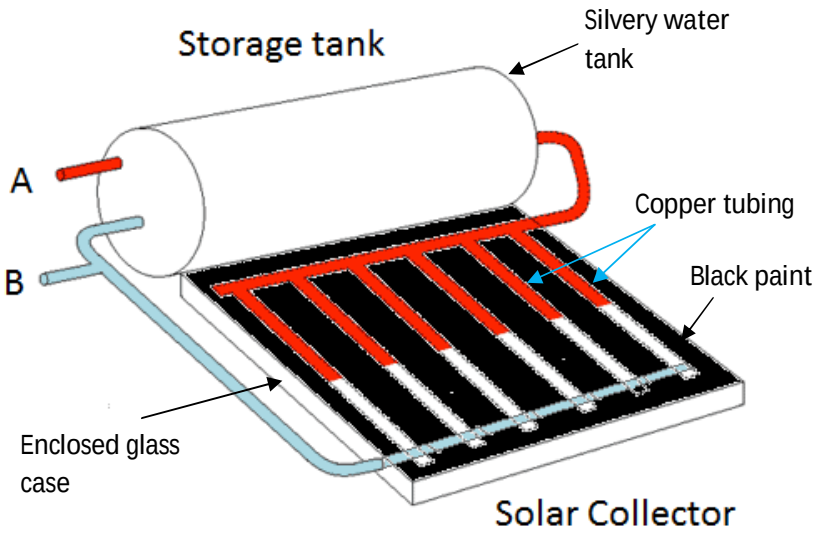
SL 3

3. (a) A solar hot water system is used to supply water in a small family home. The main features of the system are: a copper tubing, an enclosed glass case, a black paint and a silvery water tank.



Use the diagram and explain how each of the main features operates in terms of <u>convection</u>, <u>conduction</u> and <u>radiation</u>, in obtaining an effective solar hot water system.

SL 4

(i) *Copper Tubing*_____

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(ii) *Enclosed glass case*_____

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(iii) *Black paint*_____

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(iv) *Silvery water tank*_____

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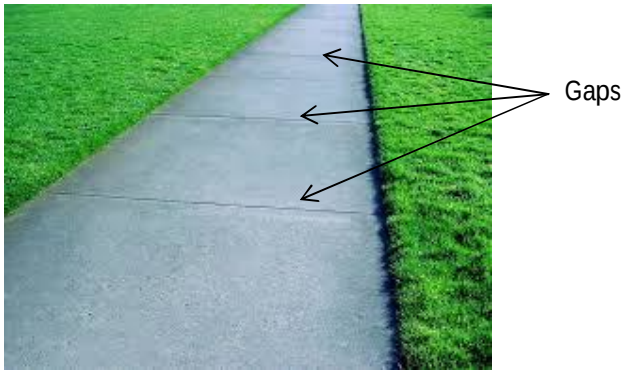
(b) Footpaths are made of concrete. Explain why gaps are built into the footpaths.



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SL 3

(c) Describe the behavior of particles in the expansion of gases when the temperature is increased.

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SL 2

(d) Convert 200^0C into Kelvin.

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SL 1

(e) Define the following terms:

(i) *latent heat*

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SL 1

(ii) *heat*

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SL 1

(iii) *temperature*

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SL 1

4. (a) State the law of magnetism.

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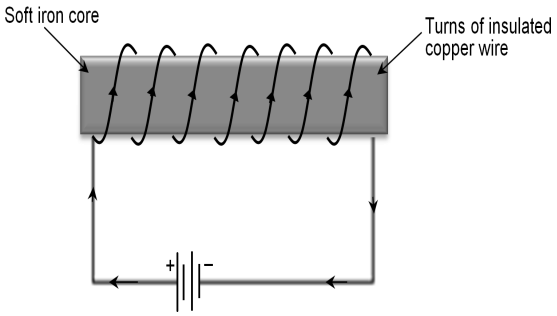
SL 1

(b) Clearly label the **poles** of the electromagnet given below.



SL 1

(c) State **ONE** way to increase the strength of an electromagnet.

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SL 1

(d) State why the magnetic field of the earth is not always parallel.

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SL 1

(e) Describe how materials can be demagnetized.

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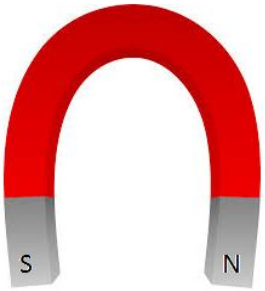
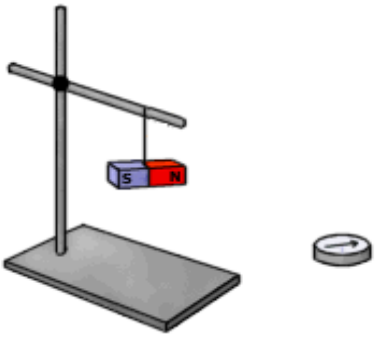
SL 2

(f) Draw the magnetic fields around the horseshoe magnet.

SL 2



(g) **Describe** what happens to a permanent magnet if it is freely suspended. **Explain** why this happens.



SL 3

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(h) Explain how electromagnets are made. You may draw a diagram to illustrate.

SL 4

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STRAND 5: ELECTRICITY Weighting 19

5. A typical circuit breaker is shown in **Figure 1**. It is an automatic safety switch which disconnects a particular electrical circuit in the house when there is an overload of current.

An overload current can start a fire in the house.

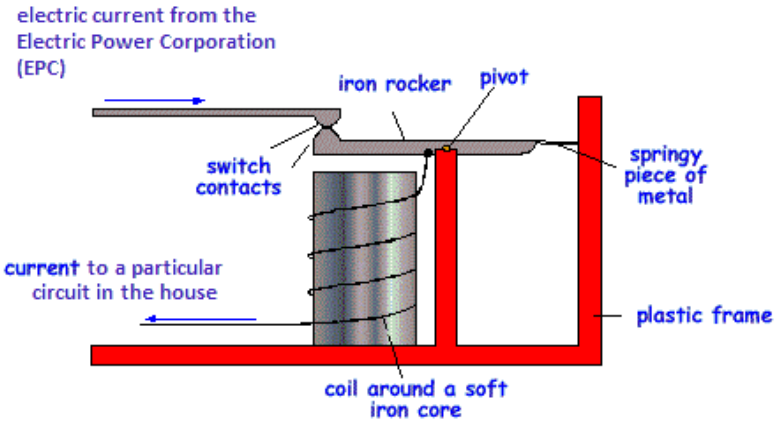
Figure 1: A circuit breaker

Figure 2 shows a number of breakers already installed at the switch board in a family home.

Figure 2: A switch board which shows several circuit breakers already installed.

The diagram below (**Figure 3**) shows the basic details of a circuit breaker.

Figure 3



(a) Study the diagram in **Figure 3** and **explain** how the circuit breaker operates when a large electric current is present.

SL 4

(b) The schematic diagram given below shows how each of the circuit breakers are connected to a family home with different resistance loads at each circuit.

(i) State the formulae for calculating unknown R in parallel connections.

SL 1

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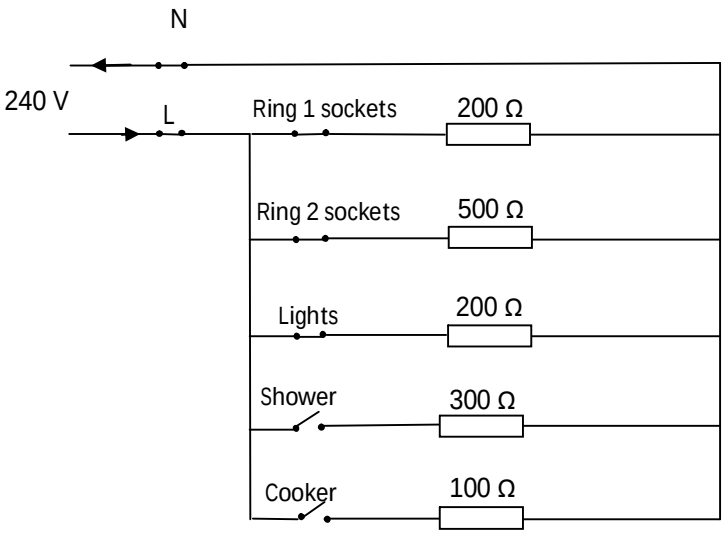

(ii) The circuit breakers for the shower and the cooker are turned off. Calculate the total resistance load in the family home.

SL 3

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(iii) If the breakers for the shower and cooker are switched on, calculate the total electric current through switch, L, if the supply voltage is 240V.

SL 2

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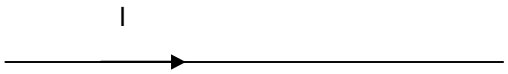
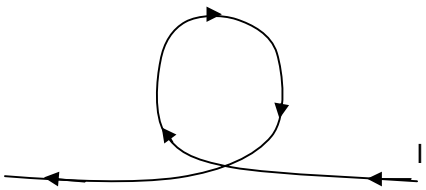
(c) Draw and label the magnetic field lines around the following wire arrangement carrying an electric current.

(i) *Straight wire*

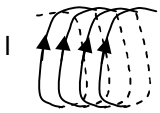
SL 3



(ii) Single loop wire



(iii) Solenoid



(d) Describe how a transformer works. You may use a diagram to illustrate it.

SL 2

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(e) Define *electrolysis*.

SL 1

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(f) State **ONE** factor affecting resistance.

SL 1

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(g) What is an electric field?

SL 1

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(h) Give TWO examples of how electricity is stored.

SL 1

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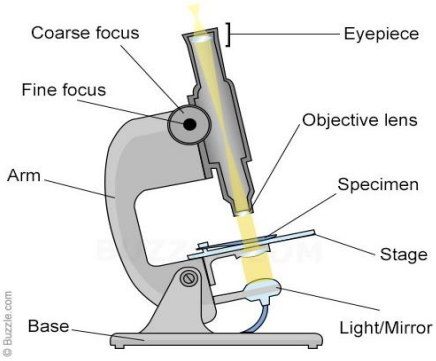
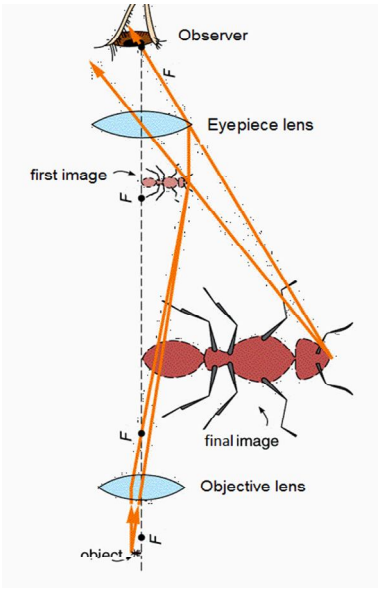
6. (a) The diagram on the right shows a simple microscope. It consists of two main lenses, the objective lens and eyepiece lens. By adjusting the distance between the two lenses, one should be able to see a small object (also known as a specimen) very clearly.



Given below is the ray diagram that shows how a small ant is magnified by light refraction through the two lenses.



Study the ray diagram and **discuss** how the small object or specimen is magnified.

SL 4

(b) Explain how rainbows are formed in terms of dispersion of light by a triangular prism. You may use a diagram to illustrate it.

SL 3

(c) A spherical mirror has a focal length of 10 cm. Calculate the position of the image if the object is located 25 cm from the mirror.

SL 3

(d) Describe an experiment or observation that shows light travelling in a straight line. You may draw a diagram to illustrate it.

SL 2

(e) Describe the difference between speed of sound and air.

SL 2

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(f) Give an example of a longitudinal wave. You may use a diagram to illustrate it.

SL 1

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(g) Define a real image.

SL 1

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(h) List the colours of the rainbow.

SL 1

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(i) Define the term *lateral inversion.*

SL 1

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(j) When light travels from air to water, the frequency remains constant.
State whether the wavelength of light will be increased or decreased.

SL 1

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PHYSICS EQUATIONS SHEET

Kinematics

$v = u + at$

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

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

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

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

$F = ma$

Electricity and Magnetism

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

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

$V = IR$

$P = VI$

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

$F = Bqv$

$V = Bvl$

List of constants

$g = 10\frac{m}{s^2}$

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

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

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

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

Heat

$Q = mc\Delta T$

$c = 4200\ J/kgK$

Energy and Mechanics

$W = Fd$

$E_P = mgh$

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

$P = F/A$

$P = W/t$

Light and Waves

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

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

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

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

$v = f\lambda$

STUDENT EDUCATION NUMBER									

PHYSICS

2017

(For Scorers only)

STRANDS	Weighting	Scores	Chief Scorer
STRAND 1: MEASUREMENTS	11		
STRAND 2: MECHANICS	23		
STRAND 3: HEAT	13		
STRAND 4: MAGNETISM	15		
STRAND 5: ELECTRICITY	19		
STRAND 6: WAVES	19		
TOTAL	**100**		