STUDENT EDUCATION NUMBER									

GOVERNMENT OF SAMOA
MINISTRY OF EDUCATION, SPORTS AND CULTURE

Samoa School 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	20	11
STRAND 2:	MECHANICS	4	41	22
STRAND 3:	HEAT	8	24	13
STRAND 4:	MAGNETISM	11	27	16
STRAND 5:	ELECTRICITY	14	34	19
STRAND 6:	WAVES	18	34	19
TOTAL			**180**	**100**

Check that this booklet contains pages 2-22 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 11

1. Define scalar and vector quantities.

SL 1

_____

_____

2. From the list, write the following quantities under the correct heading in the table given below.

List: velocity, speed, displacement, distance, force, mass, weight, acceleration, temperature, momentum, energy, work.

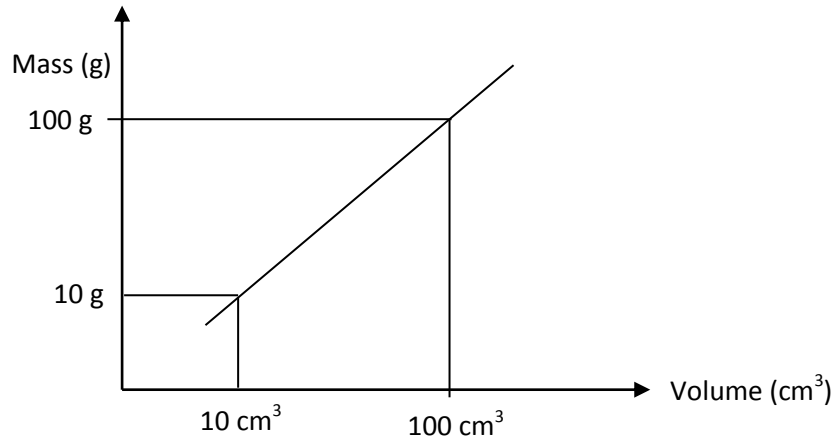
SL 3

Vector quantity	Scalar quantity

3. Simi walked 3 m east and then 4 m south. Use a scaled vector diagram to determine the resultant displacement. (**Hint:** Use a scale of 1 m = 1 cm)

SL 2

4. The graph given below shows the mass versus the volume of a liquid.
(Note that the graph is not in scale).



What is the volume of the liquid when the mass is 100 g?

_____

Determine the mass of the liquid when the volume is 200 cm^3.

SL 3

_____

What is the volume of the liquid when the mass is 5 g?

_____

5. Express 51,200 volts in megavolts.

SL 1

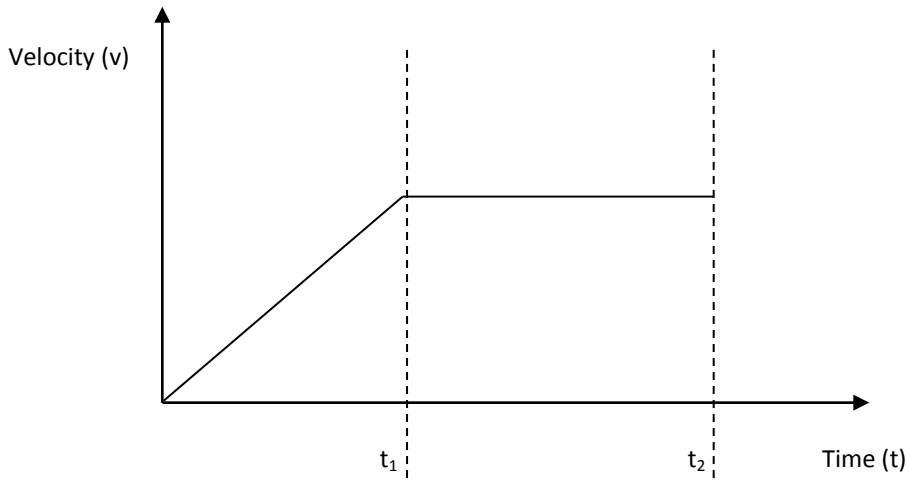
_____

6. Express 2,465,000 m in scientific notation.

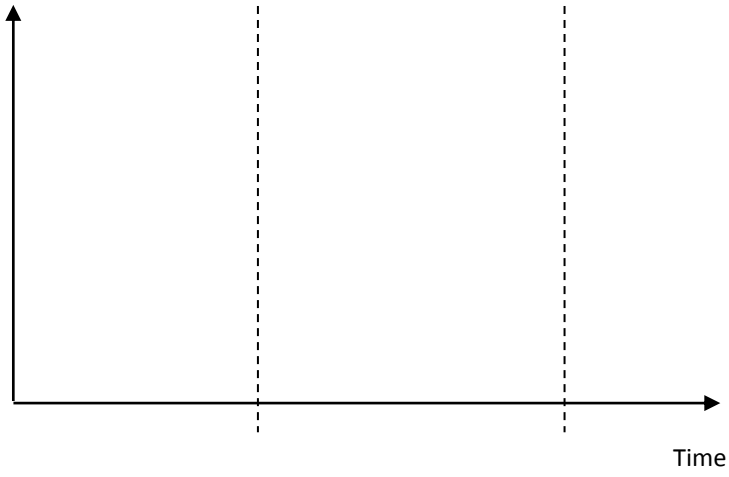
SL 1

_____

7. Use the velocity time graph to sketch the displacement time.



Displacement (m)



SL 3

8. What does the area under the velocity time graph represent?

_____

SL 1

9. How do you find the velocity from the displacement time graph?

_____

SL 1

10. What does the gradient of the velocity time graph represent?

_____

SL 1

11. A car travelling at a velocity of 20 m/s slowed down at a rate of 1 m/s^2 when it came to a stop at the red lights.

Calculate the distance travelled during deceleration until it stopped at the red lights.

_____

SL 4

Determine the time it took for the car to decelerate until it stopped at the red lights.

_____

12. A car is accelerating with a forward force of 8,000 N provided by its engine. The frictional force experienced by the car is 2,000 N.

Calculate the net force on the car.

_____

SL 2

If the mass of the car is 2000 kg, calculate the acceleration of the car.

_____

13. What is the net force on the car if the frictional force and the forward force are balanced? *(i.e. the forward force is 8,000 N and the frictional force is 8,000 N).*

_____

SL 1

14. Sina is a weight watcher. She weighs 50kg. She wanted to climb Mount Vaea to 'work out' the piece of chocolate she ate. Assume that the amount of energy in the chocolate she ate is 5,000,000 joules.

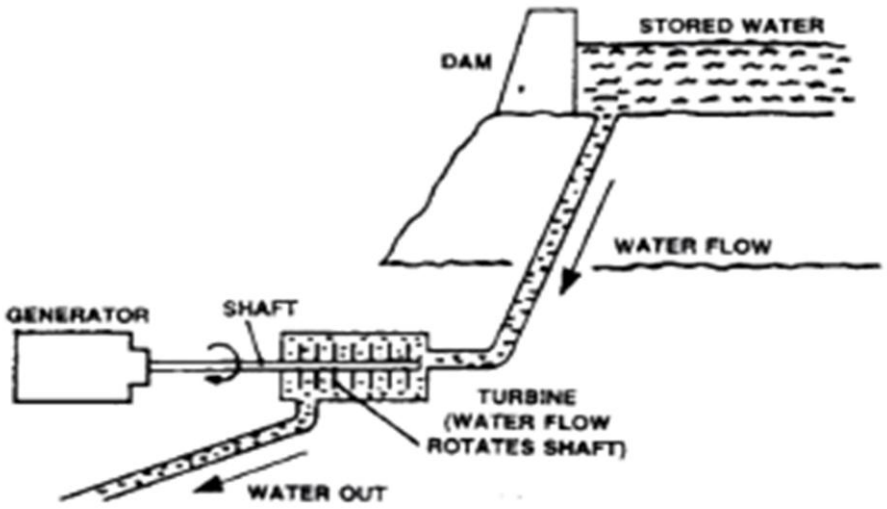
Calculate how high she must climb in order to work out the chocolate cake.

_____

SL 3

15. In the Hydro Power System, the water reservoir is usually kept at a higher level above the power house. The power house contains the turbine and the generator that produces electricity.

Use the diagram to explain how energy is converted from the stored water to generate electricity energy.



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SL 2

16. An electrical generator has an energy input of 5,000,000 Joules. If the output energy is 4,500,000 Joules, calculate the efficiency of the generator.

_____

SL 2

17. Give ONE reason why the efficiency of a real machine is always less than 100%. *(i.e. The useful work output is always less than the input energy).*

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_____

SL 1

18. State the principle of energy conservation.

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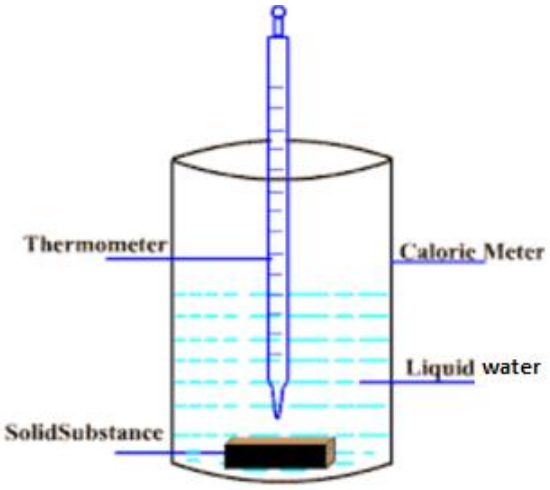
_____

SL 1

A method of mixture was used to determine the specific heat capacity of an unknown solid metal substance with mass (M_{metal}) 0.2 kg. A piece of metal was heated until it reached the temperature of 100^{o}C, and then immersed in water in the calorie meter. The mass of water in the calorie meter (M_{water}) is 0.0423 kg, and its initial temperature is 25^{o}C. As soon as the unknown solid substance was placed in the calorie meter, the water was then stirred gently until the mixture reached the final temperature of 50^{o}C.



19. Complete the following calculations in order to find the specific heat capacity of the unknown piece of metal. Write your answers in the spaces in the box.
(The first two boxes have been completed for you).

Heat gained by the water	=	Heat lost by the unknown solid metal
+ Q_{water}	=	$-Q_{unknown\ metal}$
$M_{water}\ C_{water}\ (T_{final} - T_{initial})_{water}$	=	
	=	$-(0.2\ kg)(C_{metal})(50^{o}C - 100^{o}C)_{metal}$
	=	$10C_{metal}$
C_{metal}	=	J/K.kg

SL 4

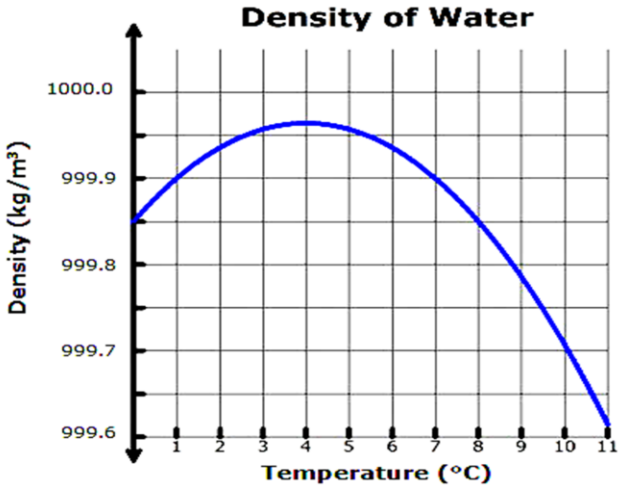
20. Use the table below to find the unknown piece of metal used in the experiment on page 8.

Metal	Specific Heat Capacity (J/K·g)	Molar Heat Capacity (J/mol•K)
Li	3.561	24.770
Mg	1.024	24.890
Al	0.903	24.350
Fe	0.449	25.100
Ni	0.444	26.070
Zn	0.389	25.400
Cu	0.385	24.440
Ag	0.235	25.350
Au	0.129	25.420
Pb	0.128	26.440

_____

SL 1

21. The graph below shows the density of water at different temperatures. Use the graph to answer the following questions.



At which two temperatures would the density of water become 999.85 kg/m^3?

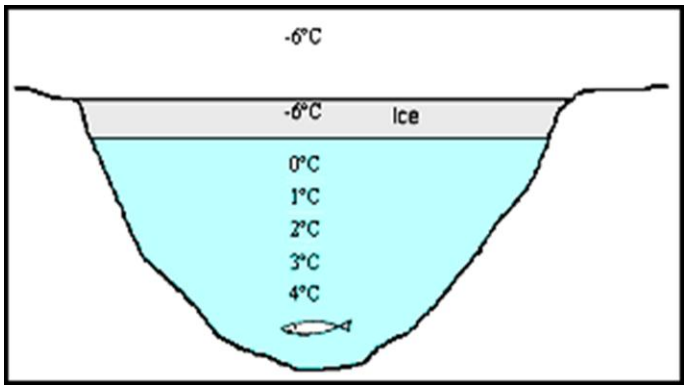
_____

SL 2

What temperature of water has the highest density?

_____

22. The variation of water density from $0^{o}C$ to $4^{o}C$ helps support the marine life during winter. Use the diagram to explain how this variation helps to support marine life.



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SL 3

23. Define **latent heat of fusion**.

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SL 1

24. Define **radiation**.

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SL 1

25. Convert $23^{o}C$ into K.

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SL 1

26. How do you demagnetize a magnet?

SL 2

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27. Describe how a single stroke method is used to make a permanent magnet.

SL 2

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_____

_____

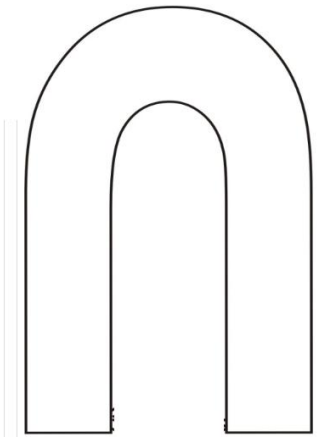
28 One of the principles of the magnetism is that *'like poles repel'*. Illustrate this concept by drawing the magnetic field lines between the two magnetic north poles.

SL 2

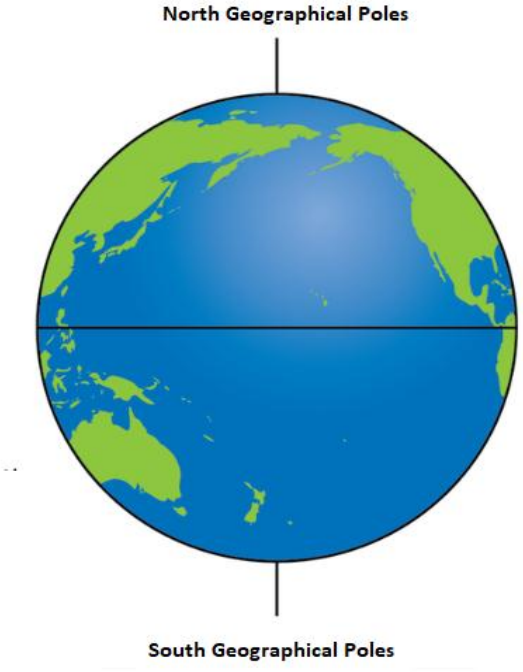
N N

29. Label the poles (N, S) of the horseshoe magnet and draw in the magnetic fields.

SL 2



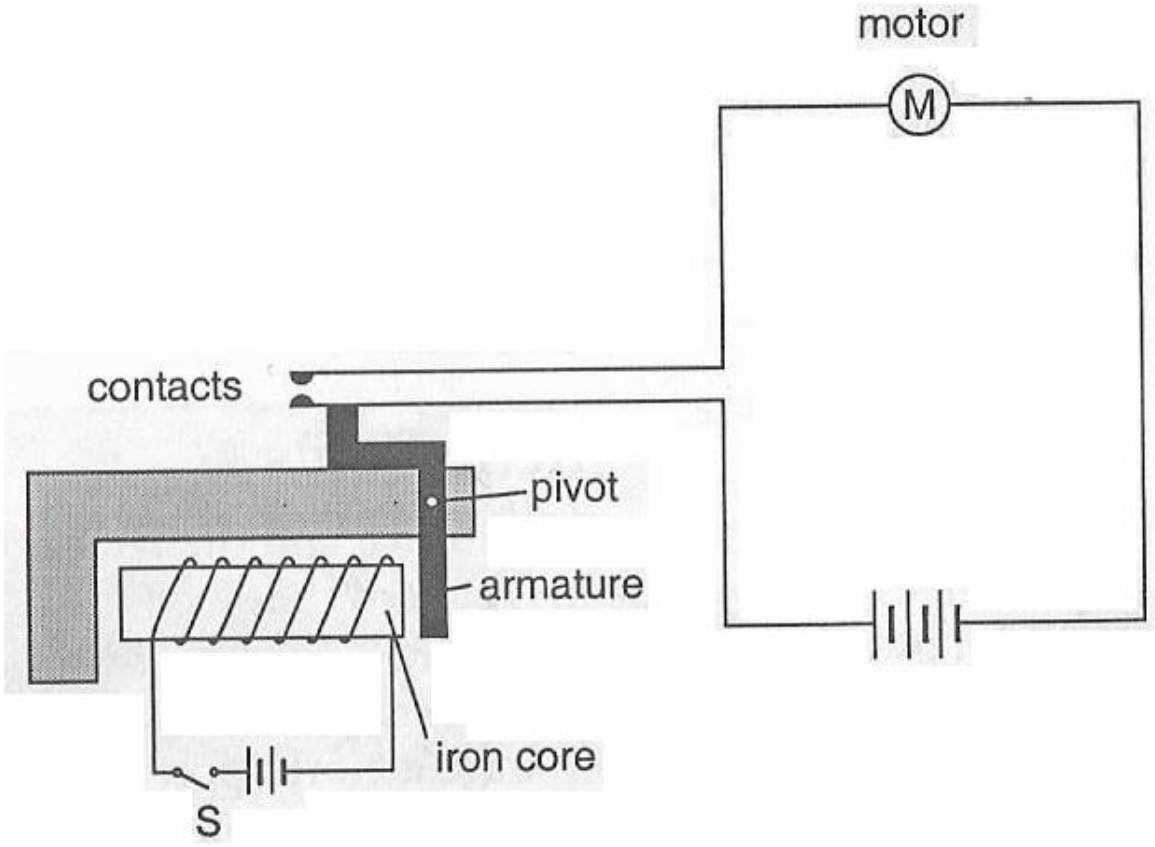
30. Describe the magnetic poles of the earth and sketch the magnetic field lines by using the diagram below.



SL 3

Use the diagram to answer the following questions.

31. The diagram given below shows a relay switch.



Label the poles of the iron core on the diagram when the switch **S** is closed.

What will happen to the iron core when the switch **S** is opened?

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SL 4

Why is soft iron used in making both the iron core and the armature instead of steel?

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If the *'armature'* is made from an aluminium metal, will the 'contacts' move together when switch **S** is closed? Give a reason for your answer.

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32. State ONE way to increase the strength of the electromagnet in the relay switch in No.31.

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SL 1

STRAND 5: ELECTRICITY Weighting 19

33. Draw a diagram to illustrate how an electroscope is charged by the induction method.

SL 4

34. Draw the electric symbol for a capacitor.

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Draw a diagram to illustrate the electric field lines across the plates of a capacitor.

SL 3

35. What is the total resistance of 100 ohms, 1000 ohms and 350 ohms resistors connected in a series?

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Calculate the total current through all three resistors, if a 12 V battery is connected in series.

SL 3

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36. Describe ONE factor that can cause the resistance of a material to change.

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SL 2

37. Draw a diagram and explain the magnetic field lines around a straight wire.

SL 2

38. Define **electric field**.

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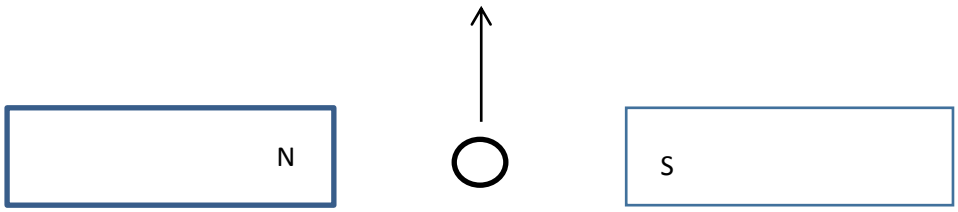
SL 1

39. **MOTOR EFFECT:** A straight wire conductor is placed between two magnetic poles as shown in the diagram below. If an electric current is passed through the straight wire conductor and the direction of this electric current is coming out of the page, which direction will the straight wire conductor move?

SL 1

40. GENERATOR EFFECT: A straight wire conductor is moving upward and across the magnetic field lines generated by the magnetic poles.

Which direction will the electric current flow?



SL 1

41. Describe how a transformer works.

SL 2

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42. A friend who does not study physics asks you to show him/her an experiment that proves light travels in straight lines.
Explain a simple physics experiment that you will show your friend to prove that light indeed travels in straight lines.

SL 4

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43. An object of 2 cm in height is placed 1 cm in front of a concave mirror. The mirror has a focal length of 2 cm. Use a ray diagram to determine the location, size and the nature of the image. *(Do not use the formula).*

SL 3

44. Discuss how refraction occurs in the human eye. *(You may use a diagram to illustrate your answer).*

SL 3

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45. Show how light is dispersed through a triangular glass prism and lists the colours in the correct order.

SL 2

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_____

46. One of the laws of refraction is that light refracts toward the normal when travelling through two different mediums. Draw a diagram to illustrate this law of refraction.

SL 2

47. Define **real image**.

SL 1

48. Define **virtual image**.

SL 1

49. Define **lateral inversion**.

SL 1

50. Write the physics formulae that define the speed of the wave in terms of wavelength and frequency.

SL 1

51. What variable in the formulae in Number 50 remains unchanged during reflection, refraction and diffraction?

SL 1

PHYSICS EQUATIONS SHEET

Kinematics

$$D = m/V$$

$$v = u + at$$

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

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

$$v = \Delta d/\Delta t$$

$$F = ma$$

Waves

$$v = f\lambda$$

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

$$S_o S_i = f^2$$

Constant: C_{water} = 4,200 J/kg ^oC or 4.2 J/g ^oC

Electricity and Magnetism

$$P = W/t$$

$$I = Q/t$$

$$V = IR$$

$$P = VI$$

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots$$

$$R_T = R_1 + R_2 + \cdots$$

Heat

$$Q = mC\Delta T$$

$$Q = mL$$

$$T_k = T_c + 273$$

Energy and Mechanics

$$W = Fd$$

$$E_p = mgh$$

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

$$\epsilon\ \% = \frac{Useful\ work}{Energy\ input} = \frac{power\ output}{power\ input}$$

STUDENT EDUCATION NUMBER									

PHYSICS

2019

(For Scorers only)

STRANDS	Weighting	Scores	Chief Scorer
STRAND 1: MEASUREMENTS	11		
STRAND 2: MECHANICS	22		
STRAND 3: HEAT	13		
STRAND 4: MAGNETISM	16		
STRAND 5: ELECTRICITY	19		
STRAND 6: WAVES	19		
TOTAL	**100**		