GOVERNMENT OF SAMOA
MINISTRY OF EDUCATION, SPORTS AND CULTURE

STUDENT EDUCATION NUMBER									

Samoa School Certificate

PHYSICS

2022

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 paper to write your answers, ask the supervisor. Write your SEN on all extra sheets used and clearly number the questions. Attach the extra sheets at the appropriate places in this booklet.
5. **All the formulas required are provided on the last page.**

STRANDS		Pages	Time (min)	Weighting
STRAND 1	MEASUREMENTS	2 - 4	20	11
STRAND 2	MECHANICS	5 - 9	41	22
STRAND 3	HEAT	10 - 12	24	13
STRAND 4	MAGNETISM	13 - 16	27	16
STRAND 5	ELECTRICITY	17 - 21	34	19
STRAND 6	WAVES	22 - 25	34	19
TOTAL			**180**	**100**

Check that this booklet contains pages 2-27 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:	MEASUREMENTS	WEIGHTING 11

For Questions 1 – 3, write the letter of your BEST answer in the box provided.

1. What is the SI unit for mass?

   A. Pound
   B. Gram
   C. Tonne
   D. Kilogram

	SL 1

2. What vector quantity has the SI unit meters per second squared?

   A. Speed
   B. Velocity
   C. Acceleration
   D. Displacement

	SL 1

3. Express 1000 km in scientific notation.

   A. $1000 \times 10^3 m$
   B. $1.0 \times 10^6 m$
   C. $100.0 \times 10^4 m$
   D. $0.10 \times 10^7 m$

	SL 1

4. These are some of the instruments used for measurement.
Write the letter of the most suitable instrument required for each given task.

A. (vernier caliper) B. (stop watch) C. (thermometer)

(i) A medical student wanting to know how long she can hold her breath under water.

_____

SL 2

(ii) A physics teacher measuring the diameter of a pencil.

_____

5. Tom was walking 200 meters due north. He then took a turn due east and continued for 300 meters. Determine Tom's resultant displacement.

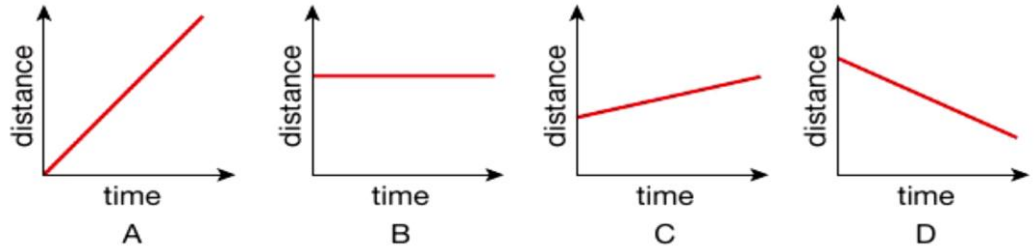
SL 3

6. Distinguish between scalar and vector quantities, and provide one example for each quantity.

SL 3

For Questions 7 – 11, write the letter of your BEST answer in the box provided.

7. The following distance-time graphs show the movement of an object along a horizontal surface. Which graph shows the object is **NOT** moving at all.



A. A
B. B
C. C
D. D

SL 1

8. State an example of gravitational force.

A. Weight
B. Normal
C. Friction
D. Spring

SL 1

9. Efficiency in simple machines is:

A. the work input over the work output.
B. the work output over the work input.
C. the work output minus the work input.
D. the work output times the work input.

SL 1

10. Density is the measure of:

A. force per area.

B. force per volume.

C. mass per area.

D. mass per volume.

SL 1

11. State the principle of energy conservation.

A. Energy can be created and can be destroyed, and it cannot be transformed from one type to another.

B. Energy cannot be created but can be destroyed and it cannot be transformed from one type to another.

C. Energy cannot be created nor destroyed, but it can be transformed from one type to another.

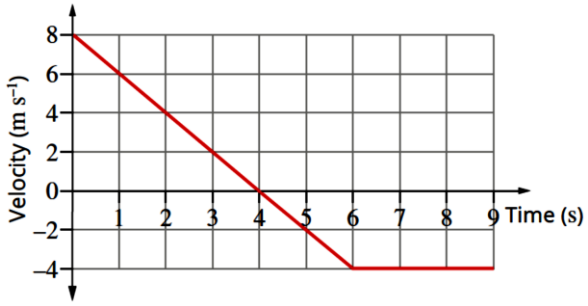
D. Energy can be created but cannot be destroyed and it can be transformed from one type to another.

SL 1

12. The distance between the Salelologa Wharf and Mulifanua Wharf is 22.6 km. What is the average speed of the Lady Samoa III if it takes 1.25 hours to travel from one wharf to the other in km per hour?

SL 2

13. The motion of a radio-controlled car, initially travelling east in a straight line across a driveway, is represented by the velocity vs time graph below. What is the displacement of the car during the first 4 seconds?



SL 3

14. Consider a ball rolling down a ramp. Explain how the energy of the ball is converted from one form to another.

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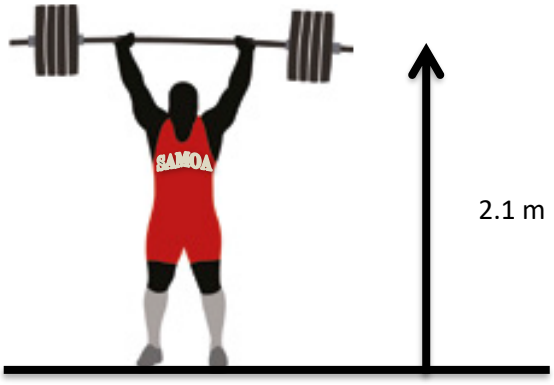
SL 2

15. A 2000 kg car has a change of velocity (Δv) of 4 ms^{-1} over 5 seconds as it travels eastward. Calculate the resultant force on the car.

SL 3

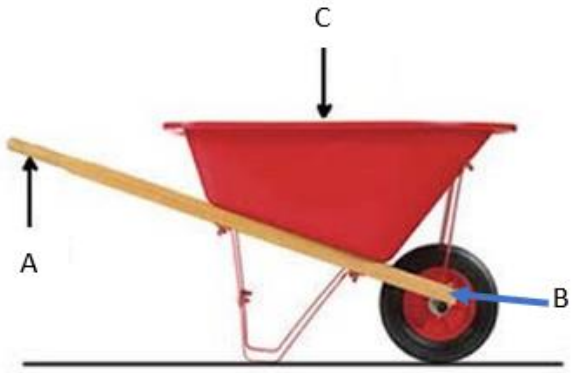
16. Don is a Samoan weightlifter. During a training session, he managed to lift 200 kg from the ground over his head at a height of 2.1 m. How much work in Joules did he perform during that lift?



SL 3

17. A wheelbarrow is one application of levers (simple machines).

(i) Use the words **Effort, Fulcrum** and **Load** to label the diagram in the spaces provided.



A. _____

B. _____

C. _____

SL 4

(ii) When using the wheelbarrow to carry a heavy object, why is it better to place the heavy object as close to the front of the wheelbarrow as possible?

_____

_____

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STRAND 3:	HEAT	WEIGHTING 13

For Questions 18 – 21, write the letter of your BEST answer in the box provided.

18. Which **ONE** of the options given best describes conduction?

A. The transfer of thermal energy by electromagnetic waves that can pass through empty space.

B. Collisions between molecules transfer energy through solid materials.

C. Higher energy molecules escape from the surface of a liquid.

D. Hot fluids rise through the cooler and denser fluid surrounding them.

	SL 1

19. Latent heat is:

A. the amount of energy that must be transferred to change the temperature of 1 kg of the material by 1^0C or 1 K.

B. the amount of energy released or absorbed during a change of state.

C. the transfer of thermal energy by electromagnetic waves that can pass through empty space.

D. when there is no longer a flow of energy between two objects in thermal contact.

	SL 1

20. Define temperature.

A. It is a measure of the amount of energy available to an object due to its position in a gravitational field.

B. It is a measure of the rate at which work is done.

C. It is a measure of the degree of hotness and coldness.

D. It is a measure of how hard it is for current to flow through a particular material.

	SL 1

21. Convert 0^0C to Kelvin.

A. 273 K

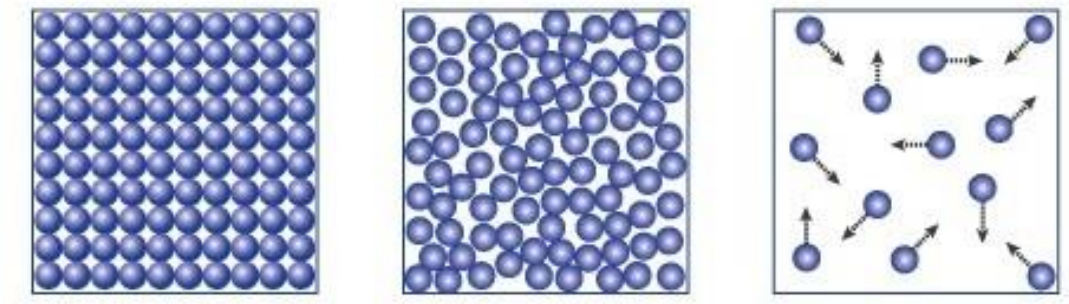
B. -273 K

C. 0 K

D. 723 K

SL 1

22. The figure below shows particles of matter at three different states.



Solid Liquid Gas

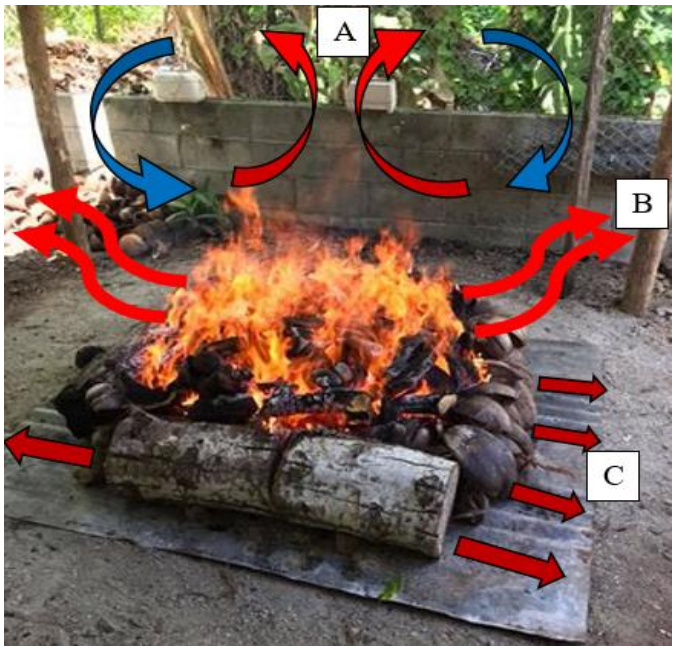
Describe the behaviour of particles during the expansion of **solid**.

SL 2

23. Calculate the amount of heat energy required to boil 100 grams of water with initial temperature of 30^0C [note: c for water is 4200 J $kg^{-1}K^{-1}$].

SL 3

24. Umu is a cooking method that is used in Samoa and it is done at home almost every Sunday. It is also a good example of identifying the three different heat transfers namely conduction, convection and radiation.



Label the diagram using the three heat transfers.

A: _____

B: _____

C: _____

SL 4

D: For heat transfer labeled B, what medium is used to transfer heat?

_____

_____

_____

_____

STRAND 4:	MAGNETISM	WEIGHTING 16

For Questions 25 – 28, write the letter of your BEST answer in the box provided.

25. State the law of magnetism.

A. Like poles attract unlike poles repel.
B. Unlike poles attract like poles repel.
C. Like charges attract unlike charges repel.
D. Unlike charges attract like charges repel.

	SL 1

26. Which of these is an example of a permanent magnet?

A. Paper clips.
B. Nails.
C. Electromagnet.
D. Bar magnet.

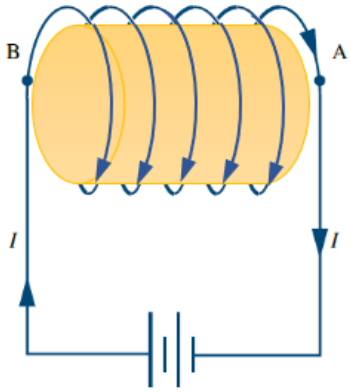
	SL 1

27. The following methods can increase the strength of electromagnets except for:

A. wrapping the coil tightly around an iron core.
B. increasing the speed of the wifi.
C. adding more turns to the coil.
D. increasing the current flowing through the coil.

	SL 1

28. Identify the poles of the electromagnet.
The following diagram shows a current carrying solenoid.



Which end represents the north pole of this solenoid?

A. A

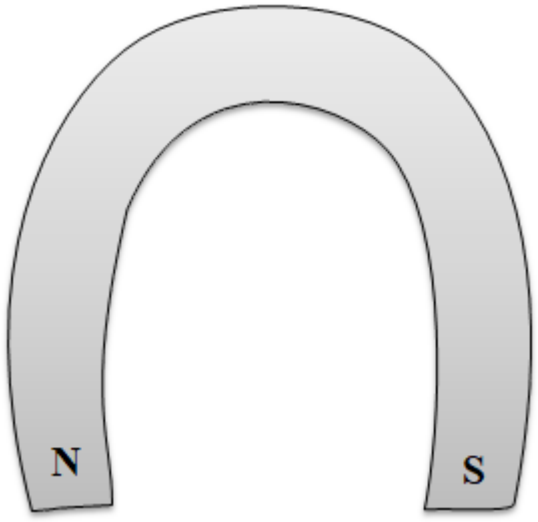
B. B

C. Neither A or B

D. Both A and B

	SL 1

29. Draw the magnetic field around the horseshoe magnet given below.



SL 2

30. Draw the interacting magnetic fields for each pair of magnets and state their results in terms of repulsion or attraction.

A.

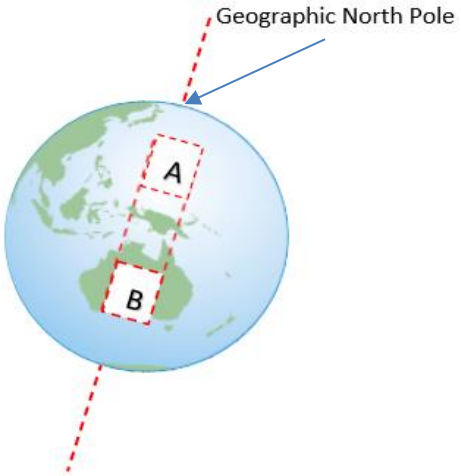
SL 3

B.

_____

_____

31. Sketch the magnetic field lines (clearly showing the direction using arrows) on the figure below and clearly label the diagram using Magnetic North Pole and Magnetic South Pole.



SL 3

Label A: _____

Label B: _____

32. The figure below shows apparatus required for making an electromagnet.

source: https://www.wikihow.com/Create-a-Magnet-With-a-Wire-and-a-Nail

A. From the apparatus in the figure above, what are the **THREE** main materials to be connected to make an electromagnet?.

_____

B. Demonstrate by drawing a diagram **OR** by listing three simple steps on how to make an electromagnet using the apparatus in the figure.

_____

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SL 4

For Questions 33 – 35, write the letter of your BEST answer in the box provided.

33. Define the electrolysis of water.

A. It is the process of using electrodeposition to coat an object in a layer of metal.

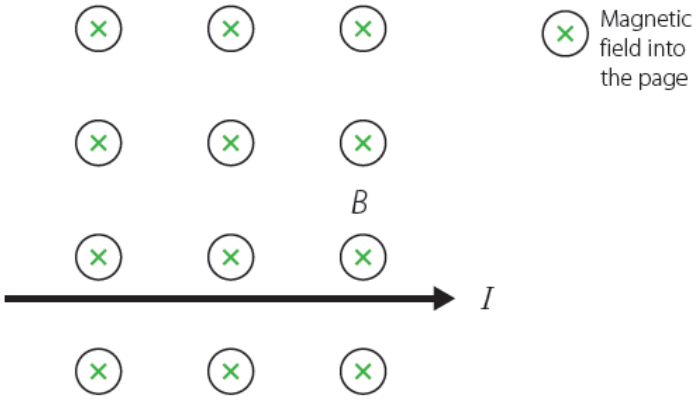
B. It is a large-scale process used to manufacture chlorine from salt.

C. It is the process of using electricity to decompose water into oxygen and hydrogen gas.

D. None of the above.

	SL 1

34. A magnetic field is pointing into the page and a current-carrying wire is sitting in the plane of the page carrying current to the right. What is the direction of the force on the wire due to the magnetic field?



A. Left

B. Out of the page

C. Up

D. Down

	SL 1

35. The unit of electric current, the ampere, is equivalent to which of the following?

A. V.Ω

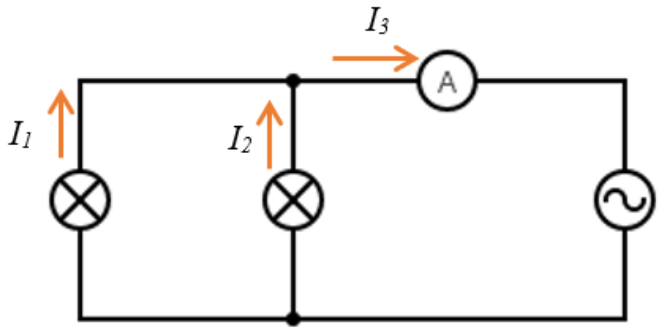
B. V/Ω

C. Ω.m

D. V/s

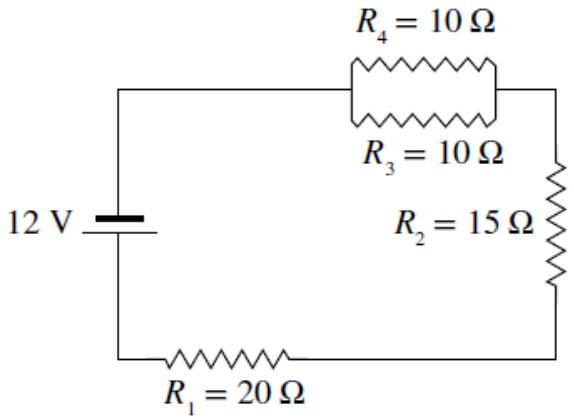
SL 1

36. Calculate the current I_3 as read by the ammeter if $I_1 = 0.5\ A$ *and* $I_2 = 1.5\ A$.



SL 2

37. Using the circuit diagram below, calculate the equivalent resistor for R_3 and R_4 and label it R_{34}.

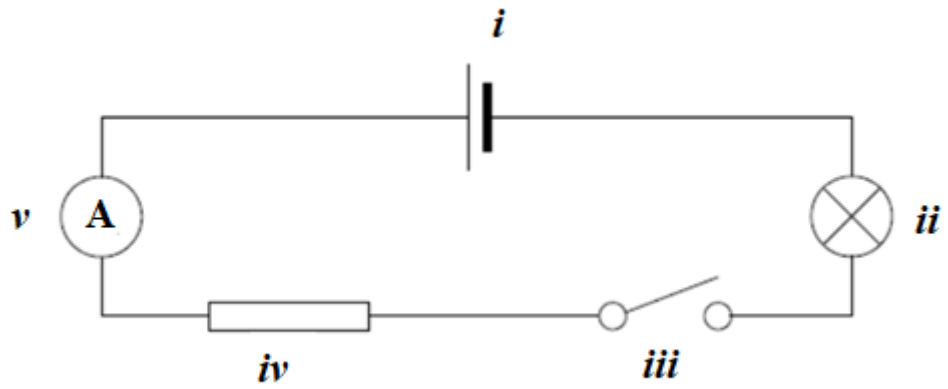


SL 3

38. When a 24.0 Ω resistor is connected across a 12.0 V battery, a current of 482 mA flows. What is the power output delivered by the emf of the battery?

SL 3

39. List the electronic devices shown in the circuit diagram below.



SL 4

i: _____

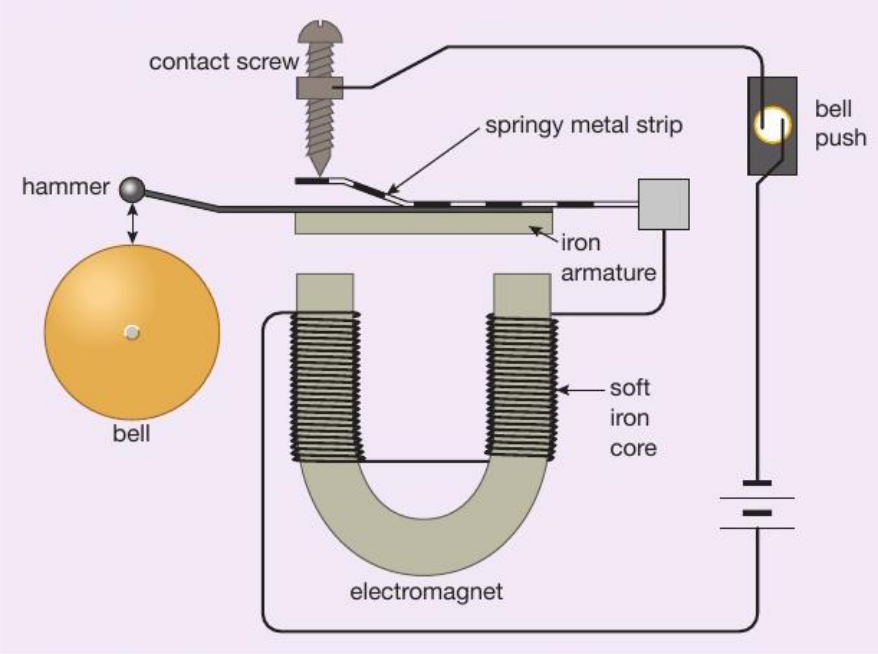
ii: _____

iii: _____

iv: _____

v: _____

40. Explain the practical application and working principles of an electric bell as shown in the figure below. [Guiding words: *current, magnetized, attract, demagnetized, spring*]



SL 4

For Questions 41 – 45, write the letter of your BEST answer in the box provided.

41. Give an example of a longitudinal wave.

A. Surface ripples on water.
B. Radio wave.
C. Microwave.
D. Sound wave.

	SL 1

42. In which part of the ear is the cochlea?

A. Outer ear.
B. Middle ear.
C. Inner ear.
D. Ear canal.

	SL 1

43. Which of the following definitions is **NOT** true about virtual images when using concave mirrors?

A. Upright.
B. Enlarged.
C. Located at the same side of the mirror with the object.
D. Cannot be projected on a screen.

	SL 1

44. List the colours of the rainbow in the order of increasing frequency.

A. Red, orange, yellow, blue, green, indigo and violet.
B. Red, yellow, orange, green, blue, violet and indigo.
C. Red, orange, yellow, green, blue, indigo and violet.
D. Red, yellow, orange, green, blue, indigo and violet.

	SL 1

45. The lateral magnification for a flat mirror is:

A. a function of the object distance.

B. a function of the image distance.

C. a function of the object and image distance.

D. the image distance divided by the object distance.

	SL 1

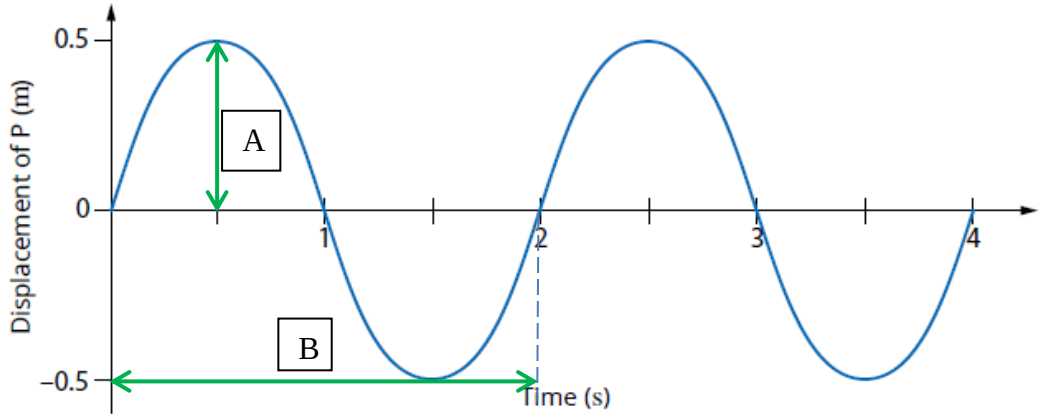
46. The paragraph below describes how the ear acts as a receiver. Fill in the gaps using the given words to complete the paragraph.

(middle ear, outer ear, eardrum, ear canal)

Sound waves enter the _____ and travel through a narrow passageway called the _____, which leads to the _____. The eardrum vibrates from the incoming sound waves and sends these vibrations to three tiny bones in the _____.

SL 2

47. The displacement-time graph below shows the motion of a single part of a rope (point P) as a wave passes by travelling to the right.



State the labels for the given letters.

A: _____

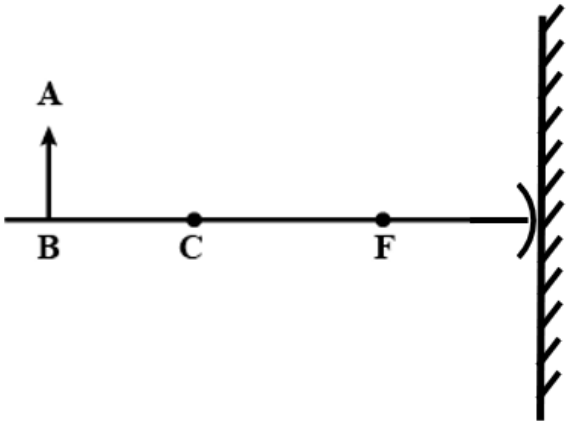
B: _____

SL 2

48. Calculate the speed of a longitudinal wave that has a wavelength of 2.0 m and a frequency of 170 Hz.

SL 3

49. Use two rays to locate the image of object A that is positioned at B in front of the concave mirror shown in the figure below. Label the image that you found as A' and mark its location with D.



SL 3

50. Discuss the applications of refraction in real-life such as the human eye.

[Some guiding questions: What material does it contain? (mirrors or lenses) Images from this equipment can be projected on a screen, why? (Does it form real or virtual images, and are the images inverted or upright?) What magnification does it have? (>1, <1 or = 1)]

SL 4

PHYSICS EQUATIONS SHEET

Kinematics

$$v = u + at$$

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

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

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

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

Heat, Energy and Mechanics

$$Q = mc\Delta T$$

c is the specific heat capacity

$$F = ma$$

$$W = Fd$$

$$E_p = mgh$$

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

$$E_s = \frac{1}{2}kx^2$$

$$\rho = \frac{m}{V}$$

$$P = \frac{F}{A}$$

Electricity and Magnetism

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

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

$$V = IR$$

$$P = VI$$

$$P = I^2R$$

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

$$F = Bqv$$

$$V = Bvl$$

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

parallel

$$R_T = R_1 + R_2$$

series

Constants

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

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

$$G = 6.67 \times 10^{-11}\ N\ m^2C^2$$

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

$$c_{water} = 4200\ J\ kg^{-1}K^{-1}$$

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

2022

(For Scorers only)

STRANDS		Weighting	Scores	Check Scorer	AED check
STRAND 1	MEASUREMENTS	11			
STRAND 2	MECHANICS	22			
STRAND 3	HEAT	13			
STRAND 4	MAGNETISM	16			
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TOTAL		**100**			