



STUDENT EDUCATION NUMBER									

Samoa School Certificate

PHYSICS 2021

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 page 31.**

STRANDS		Pages	Time (min)	Weighting
STRAND 1	MEASUREMENTS	2	20	11
STRAND 2	MECHANICS	5	41	22
STRAND 3	HEAT	10	24	13
STRAND 4	MAGNETISM	15	27	16
STRAND 5	ELECTRICITY	20	34	19
STRAND 6	WAVES	26	34	19
TOTAL			180	100

Check that this booklet contains pages 2-32 in the correct order and that none of these pages are blank.

HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

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

1. Which of the following is the fundamental unit of time?

- A. Meter
- B. Second
- C. Kelvin
- D. Kilogram

	SL 1

2. Which of the following instruments is **best** used for measuring the diameter of a wire?

- A. Ruler
- B. Measuring tape
- C. Vernier caliper
- D. Micrometer

	SL 1

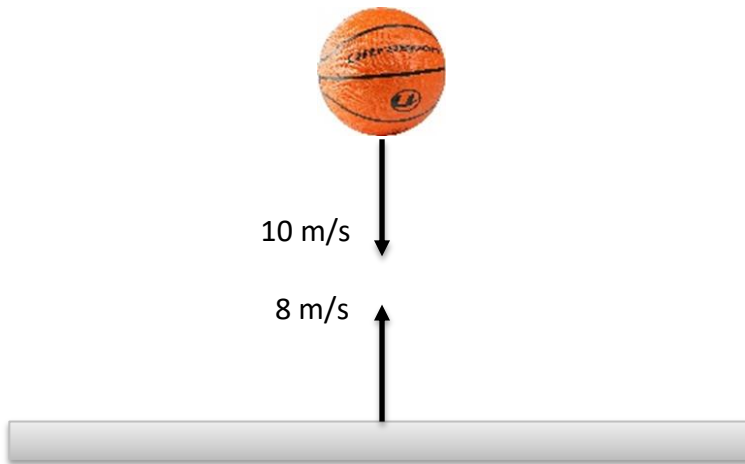
3. 0.000 0024 when expressed in scientific notation is:

- A. 2.4×10^{-6}
- B. 2.4×10^6
- C. 24×10^{-6}
- D. 24×10^6

	SL 1

Use the information given below to answer Question 6.

A basketball strikes the ground at 10 m/s and rebounds at 8 m/s as shown in the diagram below.



6. Calculate the magnitude and direction of the basketball's **change in velocity**.

SL 3

For Questions 7 – 14, write the letter of your BEST answer in the box provided.

7. Which of the following is an appropriate definition of **distance**?

- A. Half length travelled.
- B. Shortest length travelled.
- C. Longest length travelled.
- D. Total length travelled.

SL 1

8. A batsman hits a cricket ball, which then rolls on a level round. After covering a short distance, the ball comes to rest. Which force brings the ball to rest?

- A. Frictional force.
- B. Magnetic force.
- C. Muscular force.
- D. Gravitational force.

SL 1

9. What does the gradient of a velocity against time graph represent?

- A. Time
- B. Velocity
- C. Acceleration
- D. Displacement

SL 1

10. What is the density of an object defined as?

- A. Mass of the object added to its volume.
- B. Mass of the object divided by its volume.
- C. Volume of the object divided by its mass.
- D. Volume of the object multiplied by its mass.

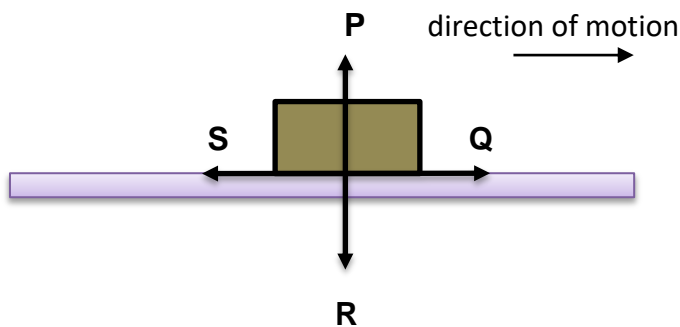
SL 1

11. Which of the following represents stored energy due to position?

- A. Kinetic energy.
- B. Potential energy.
- C. Nuclear energy.
- D. Heat energy.

	SL 1

12. The mass shown below is moving to the right as shown.



Which of the forces labelled **P**, **Q**, **R** or **S** on the diagram is the friction force?

- A. **P**
- B. **Q**
- C. **R**
- D. **S**

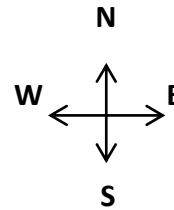
	SL 1

13. Which of the following is the appropriate name for the distance travelled in a given direction per unit time?

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

	SL 1

14. Thomas walks 2 km North from point A and then moves 3 km West and lastly he moves 1 km South to point B as shown by the diagram. (Diagram not drawn to scale)



Which vector below correctly shows Thomas' displacement?

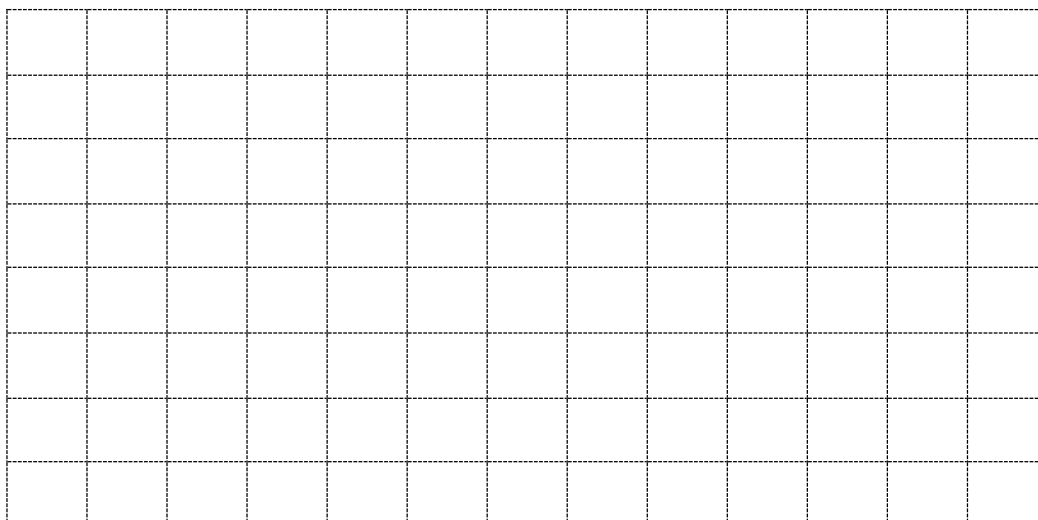
- A.
- B.
- C.
- D.

	SL 1

Use the information given below to answer Question 15.

A car starts from rest and accelerates at 2 m/s^2 for 2 seconds. From time 2 seconds to time 6 seconds, it travels with a constant velocity. From time 6 seconds to time 10 seconds it travels in the opposite direction.

15. In the grid below, draw and label a graph of velocity against time.



SL 3

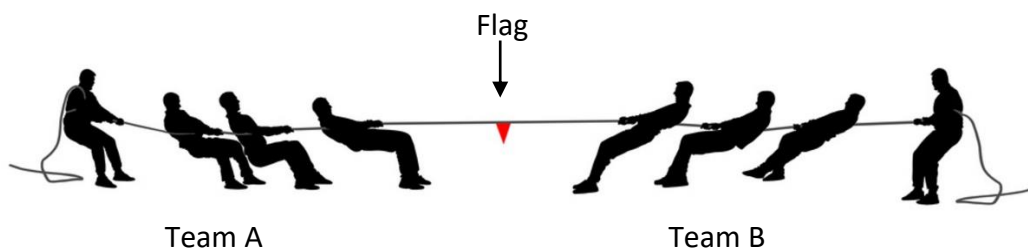
16. The density of softwood is 600 kg/m^3 .
Find the volume of a piece of softwood that has a mass of 120 g.

SL 2

17. A rocket that has a mass of 800 kg is launched into space. During take off the rocket engine exerts an upward force of 15 000 N on the rocket. Calculate the magnitude and the direction of the resultant force on the rocket.

SL 3

18. The diagram below shows a tug of war competition between Teams A and B.



With reference to the diagram above, predict with reasons the effects of balanced and unbalanced force on the motion of the flag and the outcome of the competition.

SL 4

19. Describe how a steel ship floats using Archimedes' principle of floatation.

SL 2

For Questions 20 – 23, write the letter of your BEST answer in the box provided.

20. Which of the following is the **best** definition of convection?

- A. The movement of energy from one atom to another atom.
- B. The movement of heat in liquids and gases.
- C. The movement of heat energy by electromagnetic radiation.
- D. The movement of heat in solids.

SL 1

21. The degree of hotness of an object is best named by which of the following terms?

- A. Temperature
- B. Heat
- C. Energy
- D. Matter

SL 1

22. While building the foundation of a house, concrete is reinforced with metal rods. A builder goes out to buy the metal rods from a hardware store. The table below shows the price list with specifications for the items of interest.

Materials	Price	Specifications (for linear expansion)
Concrete	\$10 per bag	0.000011 per Kelvin
Iron	\$1 per rod	0.000012 per Kelvin
Brass	\$0.50 per rod	0.000019 per Kelvin
Steel	\$0.90 per rod	0.000011 per Kelvin
Aluminium	\$1.50 per rod	0.000026 per Kelvin

Which of the metal rods, in terms of its **linear expansion**, in the table above should the builder buy to reinforce the concrete foundation?

- A. Iron
- B. Brass
- C. Steel
- D. Aluminium

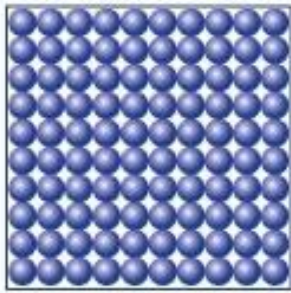
SL 1

23. What is 23°C when converted into Kelvin?

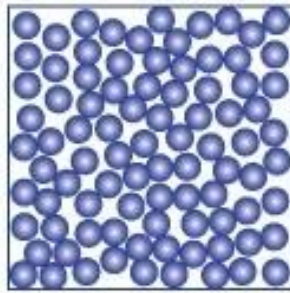
- A. 293K
- B. 294K
- C. 295K
- D. 296K

SL 1

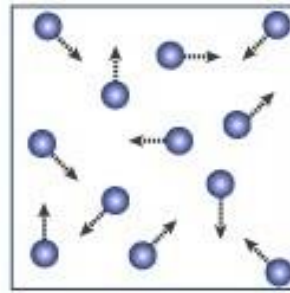
24. The diagram below shows the behaviour of particles in solid, liquid and gas.



Solid



Liquid



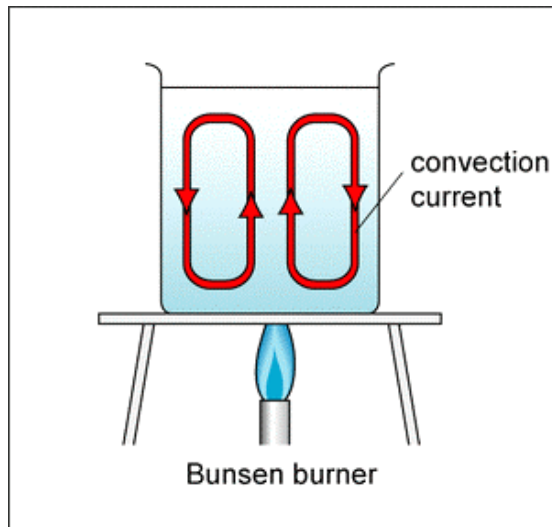
Gas

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

SL 2

Use the information given below to answer Question 25.

The diagram shown below illustrates the convection current that takes place while heating water.

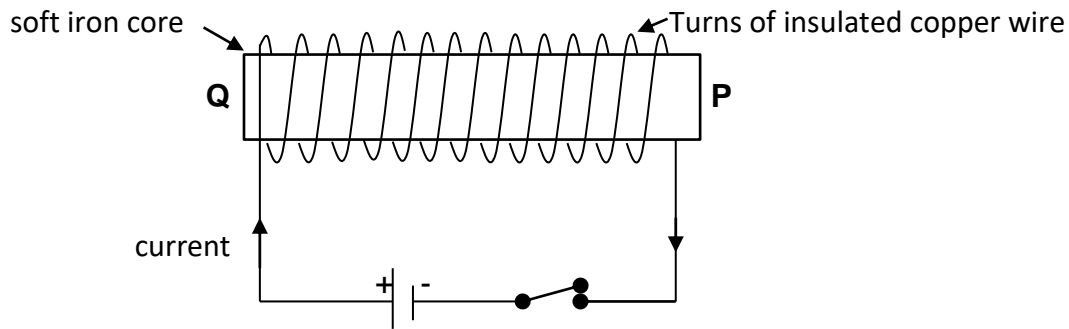


25. Explain how convection occurs while heating water.

SL 3

For Questions 27 – 31, write the letter of your BEST answer in the box provided.

27. The diagram given below shows a simple electromagnet setup. A coil of insulated copper wire wrapped around a soft iron core is connected to a battery.



What is the direction of the pole generated at the end **Q** of the solenoid?

- A. East
 B. West
 C. North
 D. South

	SL 1

28. Which of the following is NOT an example of electromagnet?

- A. Compass Needle
 B. Headphones
 C. Transformers
 D. Motors

	SL 1

29. Two strong magnets are brought together as shown below:



What is the likely action of the two magnets?

- A. They will repel.
- B. They will rotate.
- C. They will attract.
- D. They will neutralize each other.

	SL 1

30. Which of the following properties makes materials suitable for use as a core in an electromagnet?

- A. Difficult to magnetise and easy to demagnetize.
- B. Easy to magnetise and easy to demagnetize.
- C. Difficult to magnetise and retains magnetic strength.
- D. Easy to magnetise and retains magnetic strength.

	SL 1

31. Which of the following is an example of temporary magnet?

- A. Rubber
- B. Glass
- C. Plastic
- D. Paper Clips

	SL 1

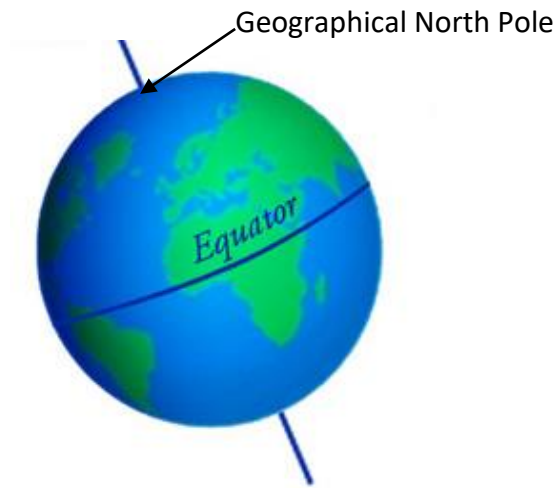
32. Iron and steel behave slightly differently as cores in an electromagnet. List **TWO** differences in the properties of iron and steel.

SL 2

33. Describe an electromagnet.

SL 2

35. The diagram below represents earth.
Sketch the magnetic fields around the earth and label fully the direction of the magnetic fields as well as the north and south poles.



SL 3

For Questions 36 – 40, write the letter of your BEST answer in the box provided.

36. Which of the following is **TRUE** of electric currents? It is the:

- A. rate of flow of charges through a circuit.
- B. product of voltage and electrical resistance.
- C. energy an electron has when in a circuit.
- D. amount of resistance an electron experiences in a circuit.

SL 1

37. Which change will **increase** the value of the resistance of a conducting wire?

- A. Its length is increased.
- B. Its temperature is decreased.
- C. Its cross-sectional area is increased.
- D. It is covered in an insulating plastic coating.

SL 1

38. What is the name of the electrical component given below?



Source: <https://www.quora.com>

- A. Diode
- B. Resistor
- C. Fuse
- D. Thermistor

SL 1

39. What is the process of applying a metal coating on another piece of metal called?

- A. Electrostatics
- B. Electromagnetism
- C. Electronics
- D. Electroplating

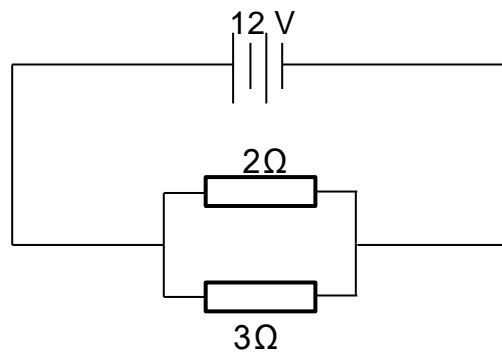
SL 1

40. What does the **product of voltage and current** give?

- A. Energy
- B. Power
- C. Inductance
- D. Resistance

SL 1

41. The circuit diagram below shows two resistors connected in parallel to a 12V DC source.



Calculate the total current in the circuit.

SL 3

42. Your Physics teacher gives you **a cell, a lamp, an ammeter, a voltmeter** and **some connecting wires** and asks you to set up a circuit to determine the power rating of the lamp.

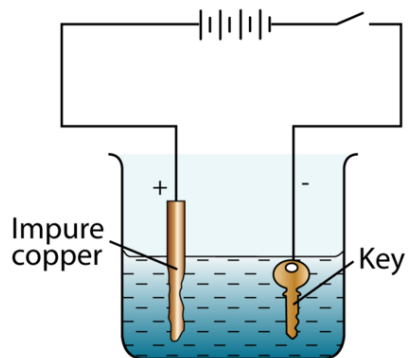
Construct an appropriate circuit diagram using all the components above to achieve this aim. Use appropriate circuit symbols.



SL 3

Use the diagram to answer Question 43.

The diagram below refers to the experiment involving the electroplating of a Key with Copper.



43. Describe the process that takes place in electroplating the key using copper.

SL 2

45. Find the total current in a circuit that has a total voltage of 30V and has two resistors $R_1 = 10\Omega$ and $R_2 = 5\Omega$ connected in series.

SL 2

For Questions 46 – 50, write the letter of your BEST answer in the box provided.

46. What does the formation of an **inverted** image on the screen of a pin-hole camera show about light? That it:

- A. creates shadows.
- B. is affected by gravity.
- C. travels in straight lines.
- D. can bend around objects.

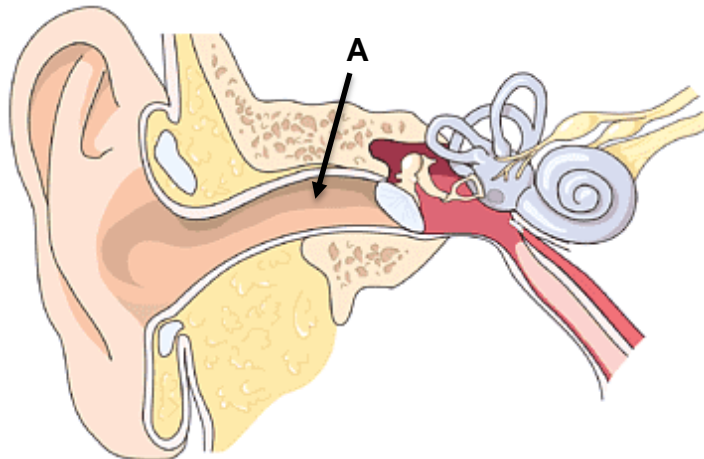
SL 1

47. Which of the following is a longitudinal wave?

- A. Ripples in a pool of water.
- B. Waves on a string.
- C. Light waves.
- D. Sound waves.

SL 1

The diagram below shows the structure of an ear.



Source: <https://www.pngwing.com/en/free-png-pevwy>

48. What is the part represented by letter **A** called?

- A. Pinna
- B. Ear drum
- C. Auditory canal
- D. Semicircular canal

SL 1

49. Which of the following features **BEST** describes the image of a person standing in front of a plane mirror?

- A. Real and upright.
- B. Real and inverted.
- C. Virtual and upright.
- D. Magnified and inverted.

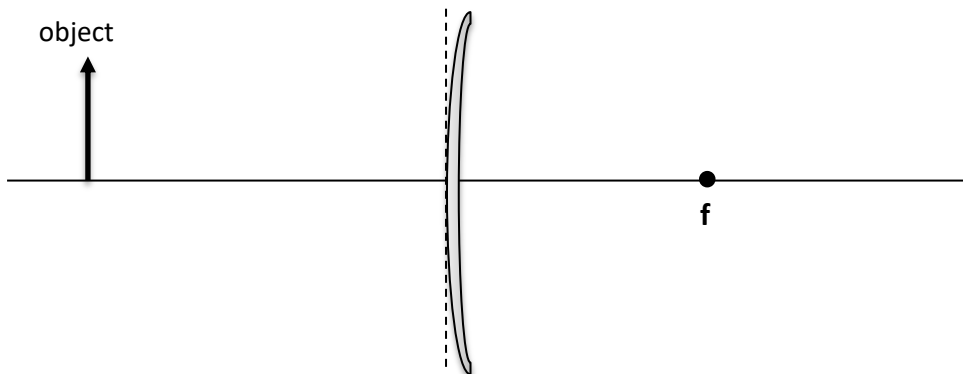
SL 1

50. Which of the following will take place when light passes through a triangular prism?

- A. Focusing
- B. Dispersion
- C. Diffraction
- D. Reflection

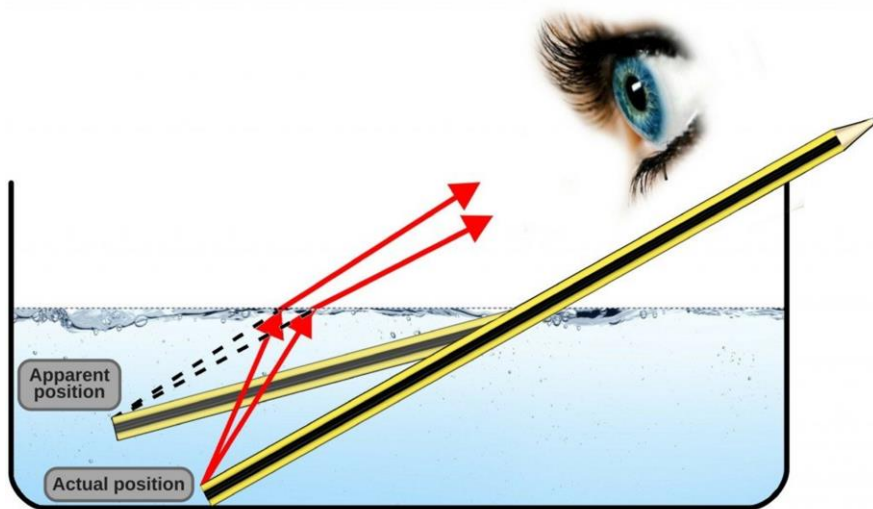
SL 1

53. An object is placed in front of a convex mirror as shown in the diagram given below. Draw a ray diagram to locate the image that will be formed by the convex mirror. Label the image found.



SL 3

54. The diagram below shows a pencil placed in a beaker of water. Discuss in detail why the pencil looks bent when placed in a beaker of water.



<https://www.scienceabc.com/pure-sciences/what-index-of-refraction-definition-examples-water-air-glass.html>

SL 4

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

$$v = f\lambda$$

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

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

$$S_o S_i = f^2$$

Electricity and Magnetism

$$P = W/t$$

$$I = Q/t$$

$$V = IR$$

$$P = VI$$

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

$$R_T = R_1 + R_2 + \dots$$

Constant:

$$C_{\text{water}} = 4,200 \text{ J/kg } ^\circ\text{C} \text{ or } 4.2 \text{ J/g } ^\circ\text{C}$$

$$g = 10 \text{ m/s}^2$$

Heat

$$Q = mC\Delta T$$

$$Q = mL$$

$$T_k = T_c + 273$$

Energy and Mechanics

$$W = Fd$$

$$E_p = mgh$$

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

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

STUDENT EDUCATION NUMBER									

PHYSICS

2021

(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			
STRAND 5	ELECTRICITY	19			
STRAND 6	WAVES	19			
TOTAL		100			