GOVERNMENT OF SAMOA
MINISTRY OF EDUCATION, SPORTS AND CULTURE

STUDENT EDUCATION NUMBER									

Samoa Secondary Leaving 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 page 22.**

STRANDS		Pages	Time (min)	Weighting
STRAND 1	MEASUREMENTS	2-4	18	10
STRAND 2	WAVES	5-7	30	18
STRAND 3	MECHANICS	8-11	46	23
STRAND 4	ELECTROMAGNETISM	12-17	50	29
STRAND 5	NUCLEAR PHYSICS	18-19	18	10
STRAND 6	ELECTRICITY	20-21	18	10
TOTAL			**180**	**100**

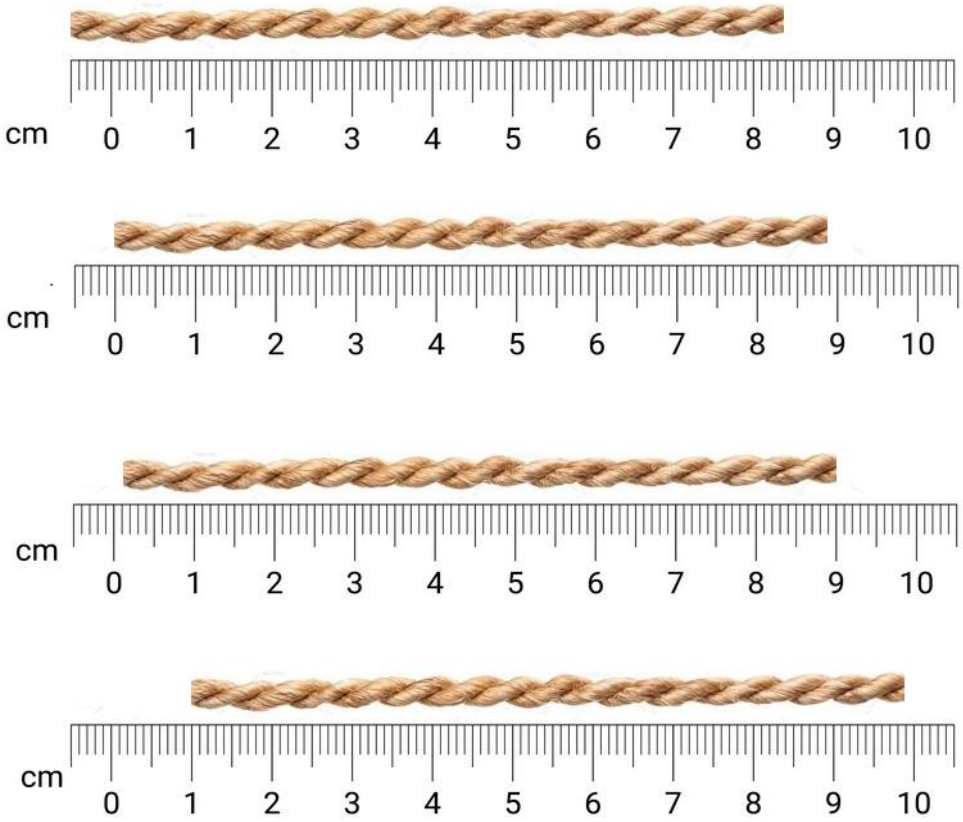
Check that this booklet contains pages 2-23 in the correct order and that none of these pages are blank.

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

STRAND 1: **MEASUREMENTS** **WEIGHTING 10**

For Questions 1 and 2, write the letter of your BEST answer in the box provided.

1. Four students measured the length of the string differently and recorded the length as shown in the table below:



Student	Length of string recorded
1	8.4 cm
2	8.9 cm
3	9 cm
4	10 cm

The most accurate reading is recorded by:

A. Student 1

B. Student 2

C. Student 3

D. Student 4

SL 1

2. If the length of the string taken at Question 1 should be reported and presented in **"cm"** and **roundup to whole number**. Which of the four students recorded the correct reading?

A. The first student.

B. The second student.

C. The third student.

D. The fourth student.

SL 1

3. Express 0.00267 ampere in milli ampere.

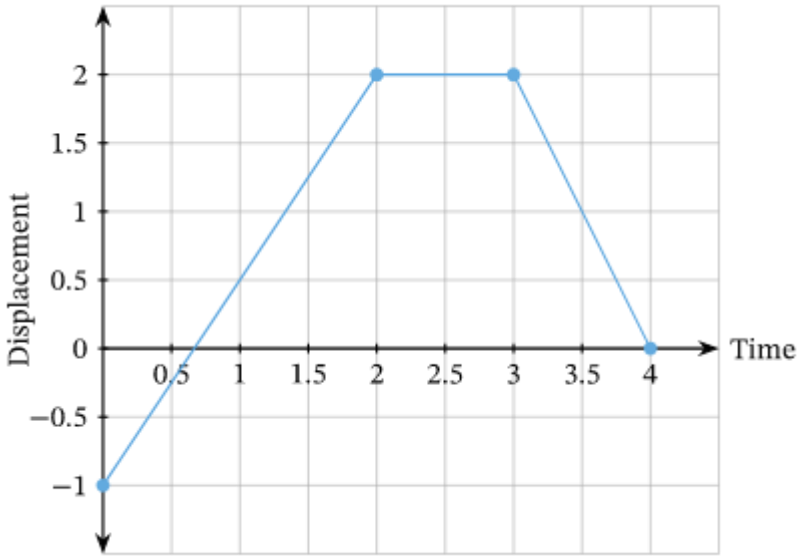
SL 2

4. A man walked from his home to a nearby store in his village. He walked 50 m North and then 70 m West. Draw a vector diagram to represent his movement and the resultant vector from his home to the store. (Hint: Use the scale 10 m = 1 cm)

SL 3

5. Calculate the slope of the displacement-time shown for the following time period. The time period between 0 – 2 seconds, 2 – 3 seconds and 3 – 4 seconds. And for each time period state what each slope represents.

SL 3



STRAND 2:	WAVES	WEIGHTING 18

For Questions 6 – 8, write the letter of your BEST answer in the box provided.

6. Which of the following is NOT a definition of the frequency of a wave?

A. The number of cycles per second.

B. The number of vibration produced in a unit time.

C. The inverse of the time period.

D. How fast the wave travels.

	SL 1

7. One of the following definitions of refractive index of an optical medium is INCORRECT. Select which one.

A. The ratio of the sine of the angle of incidence to the sine of the angle of refraction.

B. The ratio of the speeds of light when travelling from one medium to the second medium.

C. It is the speed of light in air divided by the speed of light in the denser medium.

D. It is the measure of how much white light diffracts.

	SL 1

8. A light ray travelling from water to glass at an incident angle of 35°. Determine the angle of refraction of the light ray. The refractive index of glass is 1.42 and the refractive index of water is 1.33.

A. 37.8°

B. 32.5°

C. 35°

D. 69.5°

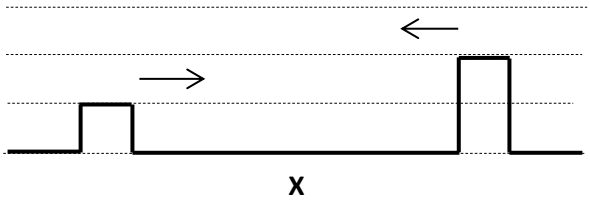
	SL 1

9. Describe what the amplitude of a wave is and include a diagram to illustrate.

SL 2

10. Two pulses of different sizes approach each other. Sketch the resultant pulse when they are wholly superimposed at point **X** and after they pass point **X.**

SL 2



11. An object is situated at a distance of 15 cm from a convex lens of focal length 30 cm. **Use the equation** to determine the position of the image.

SL 3

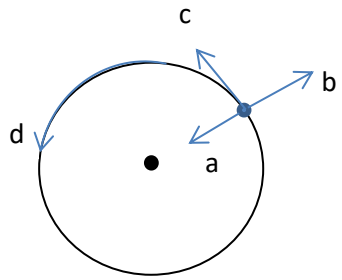
12. Discuss weaknesses of the corpuscular light model.

SL 4

13. Discuss the wave model of light. You may use a diagram or examples to illustrate.

SL 4

14. The diagram below shows an object moving at a uniform speed at the counter clockwise direction. The letter that represents the centripetal **force vector** is,



SL 1

15. Describe the relationship of the concepts of displacement and distance in motion.

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SL 2

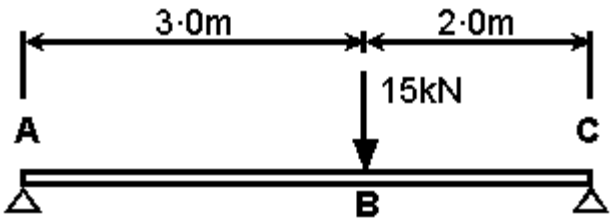
16. Toma starts walking to school every day at 7:10am. On his way to school, Toma usually stops at the shop to buy some food. He spends about 20 minutes at the shop before he continues. By the time, he reaches the school, the time is 7:45am. Calculate the average speed that Toma takes, if he walks 2,800 metres.

SL 2

17. A car of mass 5000 kg which was initially at rest, accelerated to 10 m/s in 2s. If the car continues to accelerate with this rate in the next 5 seconds, what is the momentum of the car at 7s?

SL 2

Use the information in the diagram to answer Questions 18 and 19.



18. A light beam is supported by two supports A and C. A load of 15,000 N is exerted at B. Calculate the clockwise moment about support A.

SL 2

19. Determine the load exerted on support A and C so that the system is in equilibrium.

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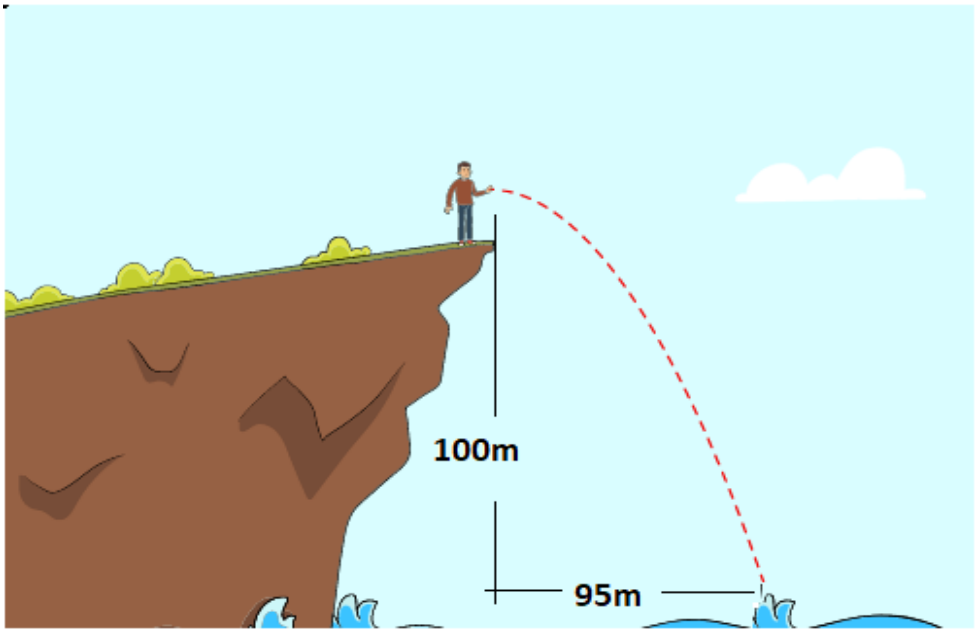
SL 3

20. A rock is thrown horizontally off a 100m cliff, it lands 95m away. At what speed was the rock thrown?



SL 3

21. Discuss what centripetal force is and how it is applied in ONE real life example.

SL 4

22. A projectile is launched from a level ground with a launch velocity of 30 meters per second and a launch angle of 70° above the horizontal. Determine the landing range of the object.

SL 4

For Questions 23 - 28, write the letter of your BEST answer in the box provided.

23. A carpenter bought an electric drill that is rated at 300W. Select the false statement about the meaning of 300W.

A. It is the power that electric drill requires to operate and do the job.

B. It is 300J of energy delivered by the electric drill per second.

C. It is 300J of work can be done by the drill in one second.

D. It is the kind of model and brand of the electric drill.

	SL 1

24. Which of the following definitions of voltage is INCORRECT?

A. It is the measure of the electric potential difference between two points in a circuit.

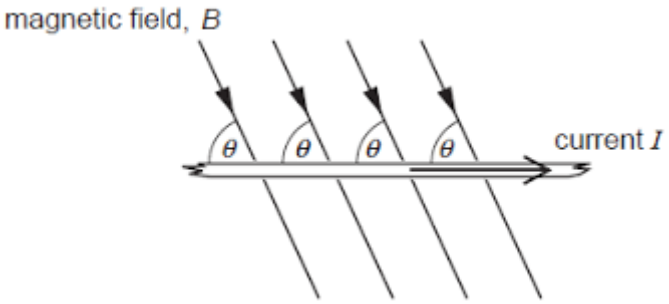
B. It is the amount of energy carried by a unit charge.

C. It is the electromotive force supplied by a battery.

D. It is the same as the electric current in an electrical circuit.

	SL 1

25. Select the angle, θ, at which the magnetic lines field lines and motion of the wire will produce **<u>minimum</u>** induced electric current, I.



A. Θ = 0°

B. Θ = 30°

C. Θ = 60°

D. Θ = 90°

	SL 1

26. The **MAIN** purpose of commutator in a DC simple motor is

A. complete the circuit.

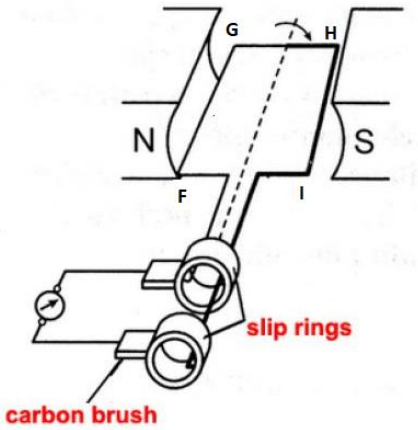
B. reverses the current in the armature.

C. provides self-lubrication.

D. all of the above.

	SL 1

27. Given below is a simple AC generator. If the generator is rotated clockwise, the correct direction flow of the induced current in the first half of the rotation (180°) in the armature is:



A. FGHI

B. FGIH

C. IHGF

D. GIHF

	SL 1

28. The correct unit of charge is:

A. A

B. C

C. V

D. W

	SL 1

29. Discus the difference between voltage and current.

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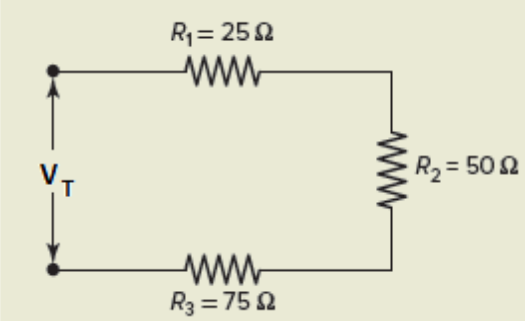
SL 2

Use the diagram below to answer Questions 30 and 31.



30. Calculate the potential difference across the resistor 50 ohms. The V_T is 100 V.

SL 2

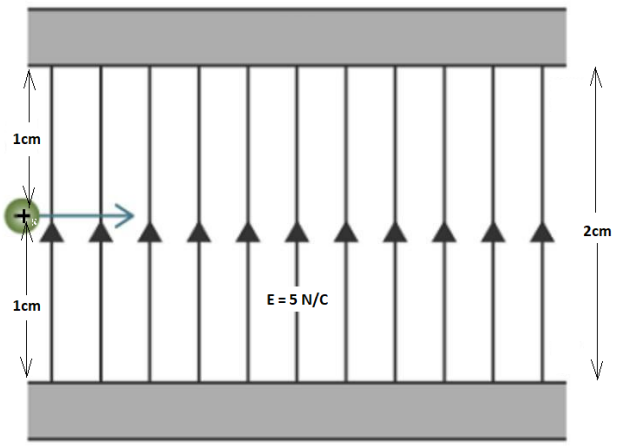
31. If an electric current of 0.5 A is passed through the resistor R_1 , what is the new value of the voltage supply, V_T?

SL 2

32. When a glass rod is rubbed with a piece of silk, both materials become electrostatically charged. Explain how they become charged.

SL 3

33.



A positive charge of 2 µC is travelling to the right between the two parallel plates of the capacitor. The distance separating the two plates is 2 cm. The electric field strength between the plates is 5 N/C. Calculate the work done by the electric field by moving the charge 1cm to the top plate of the capacitor.

SL 3

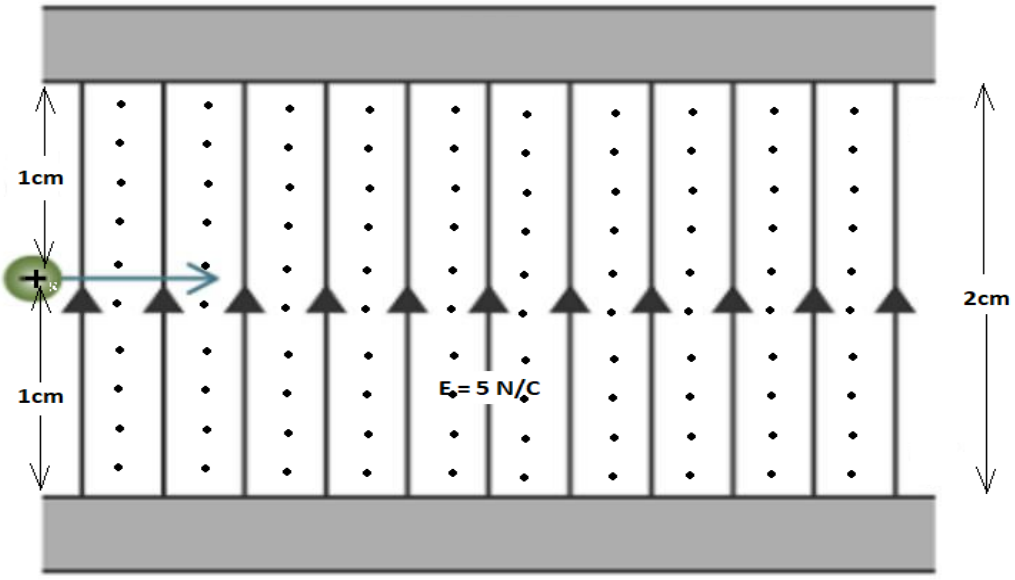
34. Refer to diagram in Question 33 (page 15). Calculate the potential differences between the two plates (2cm) and (1cm) half-way between the parallel plates.

V (2cm) =

V (1cm) =

SL 3

35.

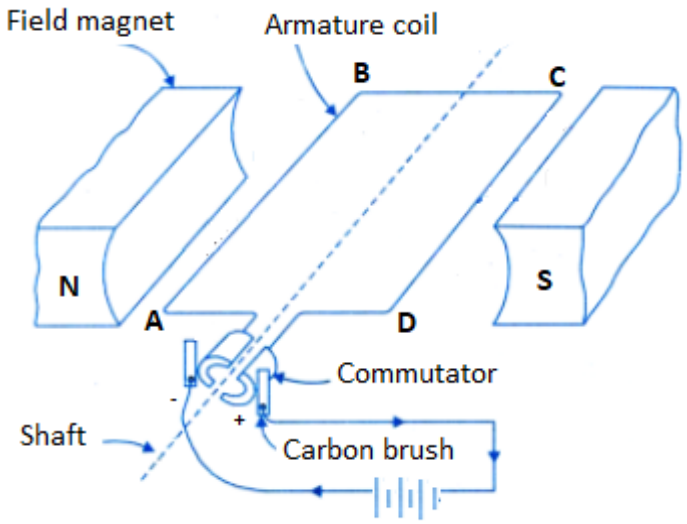


In order for the 2 µC to travel straight to the other end of the parallel plates. A magnetic field of 1 Tesla is coming out of the page (as seen as dots) is applied between the parallel plates as shown in the diagram. Calculate the velocity of the charge that it needs in order to travel straight without deviation until the end of the parallel plates.

SL 4

36. A structure of a simple DC motor is given below. Explain in details how the DC motor works. (HINT: Your responses should include the main aspects of the motor, such as the carbon brushes, the commutator, the armature ABCD, magnets, direction of the current, etc.)

SL 4



STRAND 5:	NUCLEAR PHYSICS	WEIGHTING 10

For Questions 37 and 38, write the letter of your BEST answer in the box provided.

37. Which of the following correctly define the concept of half-life?

A. It is the time required for a radioactive substance to reduce to half of its initial value.

B. It is the half-life of the planet earth before it goes through another big bang.

C. It is the law of Physics used to describe chemical reaction.

D. All of the above.

	SL 1

38. The correct definition of an isotope is:

A. Forms of the same element that have the same number of protons but different number of neutrons.

B. Forms of the same element that have the same number of neutrons with same number of electrons.

C. Forms of the same element that have the same number of electrons but different number of neutrons.

D. Forms of the same element that have the same number of neutrons but different number of electrons.

	SL 1

39. An alpha particle is the same as the helium nuclei. The Uranium 235 undergoes an alpha decay in order to form a Thorium 231. Complete the equation of the radioactive reaction by filling in the blank boxes in the equation below.

SL 2

$$^{235}_{92}U \rightarrow \square + {}^{231}\square Th$$

40. Alpha, Beta and Gamma particles take different pathways when they are allowed to pass through the magnetic field. Complete the diagram to show how each particle behaves when traveling from left to right.

SL 3

41. Compare the penetrating distances of alpha, beta and gamma radiation particles.

SL 3

For Questions 42 and 43, write the letter of your BEST answer in the box provided.

42. When making an electromagnet, one of the following materials is NOT required. Which one is it?

A. A soft iron core.

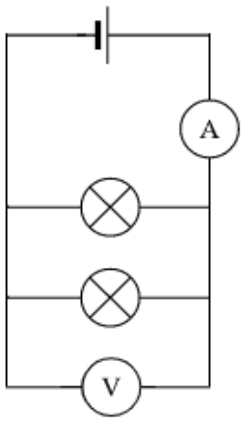
B. A piece of steel bar.

C. An insulated copper wire.

D. A DC power supply.

	SL 1

43. If two identical light bulbs are connected in parallel with a battery, which description is FALSE about the circuit?



A. The voltage across the bulbs is the same as the battery.

B. The current read by the ammeter is twice the current through each bulb.

C. The total current supplied by the battery is recorded by the ammeter.

D. The current supplied by the battery is greater than the sum of the current through each bulb.

	SL 1

44. Describe an example of an electrostatic situation.

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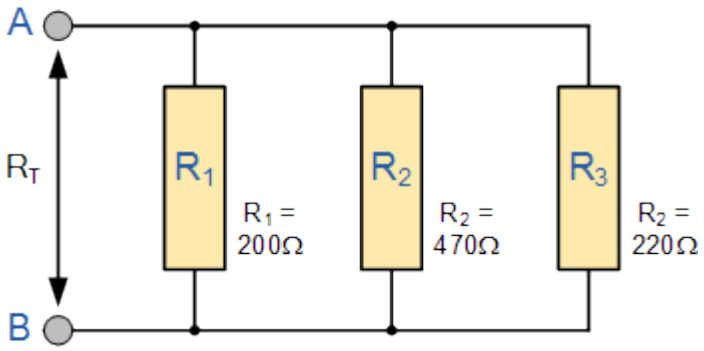
SL 2

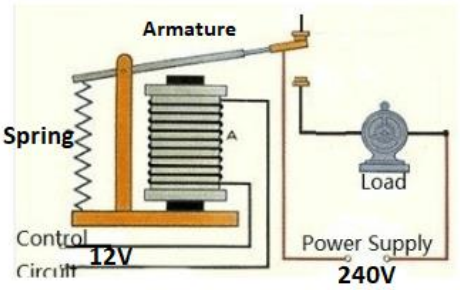
45.



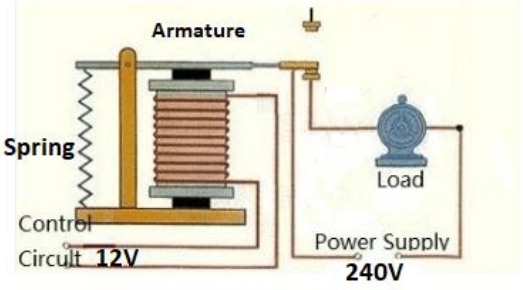
Calculate the total resistance, R_T, of the circuit given above.

SL 3

46. Use the principles of electromagnetism to explain how a magnetic relay operates to turn on a high power supply. The diagrams given below show how the relay operates when the control circuit is off and on.



Control Circuit is OFF



Control Circuit is ON

SL 3

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PHYSICS EQUATIONS SHEET

Kinematics

$v = u + at$

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

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

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

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

$p = mv$

$\Delta p = p_f - p_i$

$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

$\tau = BANI\cos\theta$

Light and Waves

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

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

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

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

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

Circular Motion

$a = \frac{v^2}{r}$

$F = \frac{mv^2}{r}$

$v = \frac{2\pi r}{T}$

Electricity and Magnetism

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

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

V = ΔE/q

V = IR

P = VI

PV =nRT

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

F = Bqv

F = IBL

P = ΔE/ t

V = Bvl

Energy and Mechanics

W = Fd

E = mgh

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

F = k x

$F = k\frac{Q_1Q_2}{r^2}$

List of constants

$e = 1.6 \times 10^{-19} C$

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

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

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

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

1 atm = 101.3 *kPa*

R = 0.08205 *L atm /mol K*

mass of the proton = 1.67 x 10^{-27} kg

h = 6.6 x 10^{-34} Js

E = hf

STUDENT EDUCATION NUMBER									

PHYSICS

2022

(For Scorers only)

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STRAND 1	MEASUREMENTS	10			
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	TOTAL	**100**			