THE SCHOOL FOR EXCELLENCE (TSFX)

VCE PHYSICS UNIT 3 & 4

WRITTEN EXAMINATION 2018

Reading Time: 15 minutes
Writing Time: 2 hours 30 minutes

QUESTION AND ANSWER BOOK

Letter

Student Number:

Structure of Book

Section	Number of questions	Number of questions to be answered	Number of marks
A	20	20	20
B	23	23	110
			Total 130

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers pre-written notes (one A3 sheet or two A4 sheets bound together by tape) and one scientific calculator.

- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

Materials Supplied

- Question and answer book of 32 pages
- Formula sheet
- Answer sheet for multiple choice questions

Instructions

- Write your **student number** in the space provided above on this page.
- All written responses must be in English.

At the End of the Examination

Place the answer sheet for multiple-choice questions inside the front cover of this book.

Students are **NOT** permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

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SECTION A – MULTIPLE CHOICE QUESTIONS

QUESTION 1
A planet has twice the mass of Earth and half the radius. Find the acceleration at the surface of the planet.

A. 39.2 ms^{-2}
B. 78.4 ms^{-2}
C. 4.9 ms^{-2}
D. 9.8 ms^{-2}

QUESTION 2
Two students are conducting an experiment to determine the relationship between horizontal launch speed and range. They are rolling three different balls off a table at speeds they judge to be slow, medium and fast. Which of the following statements is the best way to improve their experiment?

A. Only use one ball instead of three types.

B. Use a machine to control the launch speed because slow, medium and fast are not acceptable.

C. Only use one ball instead of three types and use a machine to control the launch speed because slow, medium and fast are not acceptable.

D. Use more than three different balls because you cannot get a good graph from three points.

QUESTION 3
The force of repulsion between two electric charges of 2.3 x 10^{-3} C that are 45 cm apart is:

A. 25.6 N
B. 1.07 X 10^{6} N
C. 2.6 X 10^{-3} N
D. 11.52 N

QUESTION 11

A car drives over the top a curved part of a road without losing contact with the road. At the top of the curve the road has a circular shape. The reaction between the car and the road can be found by:

A. Adding the weight of the car to the circular force (resultant).
B. Subtracting the circular force (resultant) from the weight of the car.
C. Adding the mass of the car to the circular force (resultant).
D. Subtracting the circular force (resultant) from the mass of the car.

QUESTION 12

A 300 gm ball rolls into a wall at right angles with a speed of 15 ms^{-1} and bounces straight back with a speed of 9 ms^{-1}. Find the magnitude of the change of momentum of the ball.

A. 2.7 kgms^{-1}
B. 7.2 kgms^{-1}
C. 1.8 kgms^{-1}
D. 7200 kgms^{-1}

QUESTION 13

Bill and Ben are discussing length contraction. Bill claims that only distances can display length contraction. Ben thinks that objects can also display length contraction. Who is correct and why?

A. Bill because length contraction only applies to distances travelled by very fast particles.

B. Ben because very fast particles only display time dilation.

C. Ben because both distance and objects can display length contraction. It depends on the relative velocity of the moving and inertial frame of reference.

D. Bill because length contraction only applies for particles if an observer is in an inertial frame of reference.

QUESTION 14

Five waves pass an observer every 3 seconds. Find the period of the waves.

A. 0.6 s
B. 1.66 s
C. 15 s
D. 0.6 Hz

QUESTION 15

Light passes from plastic with a refractive index of 1.65 to glass with a refractive index of 1.44. Which of the following is true?

A. There is no critical angle for this situation, as passage to air must be involved.
B. There is a critical angle as the light is passing to a less dense medium.
C. There is no critical angle because light needs to pass into a more dense medium.
D. There is no critical angle as this is a reflection situation only.

QUESTION 16

In an experiment, which of the following best describes an independent variable?

A. A variable that is kept constant during the entire experiment.
B. A variable that depends on what happens during the experiment.
C. A variable used to describe the main sources of error during the experiment.
D. A variable that is controlled and varied by the experimenter during the experiment.

QUESTION 17

Arrange the following Electromagnetic Waves in order of wavelength from smallest to largest.

Ultra Violet, Radio, Infra-red, Blue Light, Micro

A. Ultra Violet, Radio, Infra-red, Blue Light, Micro
B. Radio, Ultra Violet, Blue Light, Micro, Infra-red
C. Radio, Micro, Infra-red, Blue Light, Ultra Violet
D. Ultra Violet, Blue Light, Infra-red, Micro, Radio

QUESTION 18

Heisenberg's Uncertainty principle talks about the relationship between position and momentum and is mathematically stated as: $\Delta x \Delta p \geq \dfrac{h}{2\pi}$.

Which of the following is the most correct about applying this principle?

A. It only is significant for very small masses.
B. It is significant for all masses but we generally ignore it.
C. It applies to light waves some of the time.
D. It is only a theoretical concept and is not applicable to Physics.

QUESTION 19

Which of the following best describes the term Work Function in the Photoelectic Effect?

A. It is the work done on any electron able to escape the metal surface.
B. It is the same for all metals.
C. It is the maximum energy required to eject an electron from a particular metal.
D. It is the minimum energy required to eject an electron from a particular metal.

QUESTION 20

Which of these instruments/experiments is the best demonstration of the wave nature of electrons?

A. Electron microscope.
B. Photoelectric effect.
C. Electrons being accelerated across a potential difference.
D. Refraction of light as it changes from one medium to another.

QUESTION 4 (16 marks)

Alpha decides to build his own power system but the generator is 200 m from his house.

a. His first attempt just has power lines with a resistance of 8 **Ω.** The generator has an output of 4000 W at 250 V RMS AC.

Generator   House
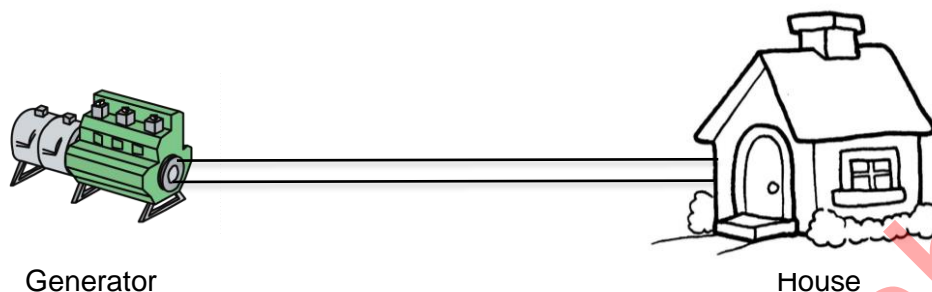
(i) Find the current in the lines.   2 marks

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	A

(ii) Calculate the voltage available at the house.   2 marks

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V	

b. Alpha decides that the voltage loss is not acceptable and consults two friends Beta and Gamma. Beta tells him to use a step down transformer near the generator. Gamma suggests two transformers are best. He would use a step up transformer near the generator and a step down transformer near the house.
Who is correct and why? 3 marks

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c. Alpha builds the system suggested by Gamma.

Generator   House

The lines still have a resistance of 8 **Ω.** Transformer 1 (T1) has N1 = 100 and $N_2 = 800$.

(i) Find the power output of T1. 1 mark

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W

(ii) Find the voltage output of T1.   2 marks

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V

(iii) Find the power loss in the lines.   2 marks

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W

(iv) Find the voltage available at the house. T2 has $N_1 = 800$ and $N_2 = 100$.   2 marks

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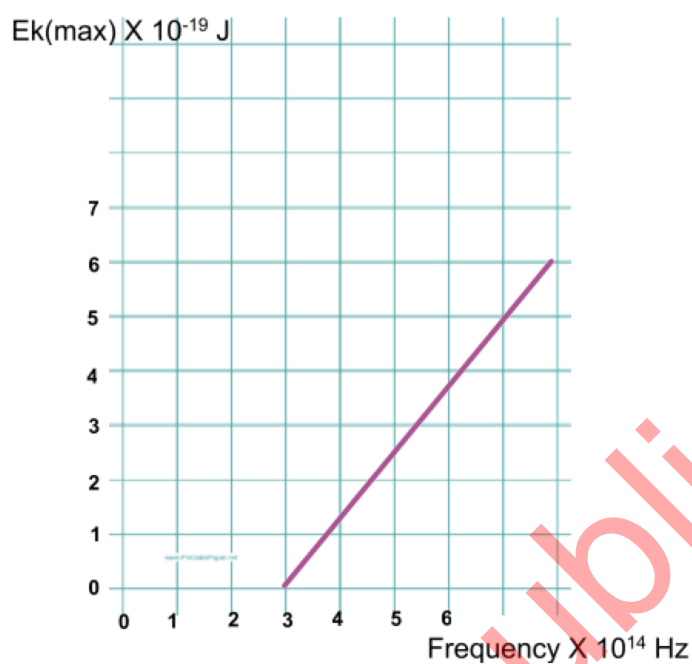_____

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V

d. Alpha also gets advice from Delta who told him that his whole system would work better if the AC generator was replaced with a DC generator just before T1. Explain why Delta's ideas are not going to help. 2 marks

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QUESTION 14 (7 marks)

This graph shows the results of a photoelectric experiment.

Ek(max) X 10^{-19} J

Frequency X 10^{14} Hz

a. Find the threshold frequency from the graph. 1 mark

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┌─────────────────────┐
│                     │
│          Hz         │
│                     │
└─────────────────────┘
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b. Find the Work Function for this metal. Describe how you found the answer. 3 marks

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┌─────────────────────┐
│                     │
│          J          │
│                     │
└─────────────────────┘
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c. Add a line to the graph that shows a different metal with a lower work function. Explain your reasoning to draw the correct line. 3 marks

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