

WOURI MOCK EXAMINATION

0580 PHYSICS 2

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MARCH/APRIL 2022

ORDINARY LEVEL

Subject Title	Physics
Paper No	Paper 2
Paper Code	0580

Two and a half hours

Answer ALL questions

Section I is designed to be answered in 1 hour and Section II in $1\frac{1}{2}$ hours.

You are advised to divide your time accordingly.

In section II answer EITHER the a, b and c OR the d, e and f of each question.

For your guidance the approximate mark for each part of a question is indicated in brackets.

You are reminded of the necessity for good English and orderly presentation in your answers.

In calculations you are advised to show all the steps in your working, giving your answer at each stage.

Where necessary, assume:

- the acceleration of free fall, $g = 10 \text{ m s}^{-2}$.
- the speed of light in air, $c = 3 \times 10^8 \text{ m s}^{-1}$
- the charge on an electron, $e = 1.6 \times 10^{-19} \text{ C}$

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Calculators are allowed.

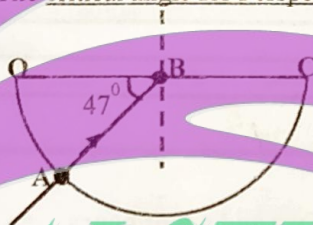
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SECTION I (1 Hour)

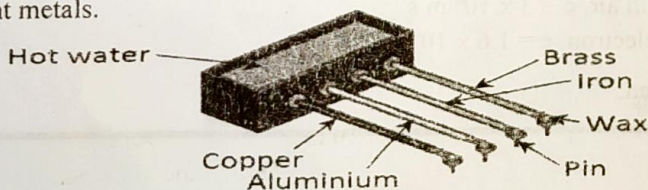
Answer ALL Questions.

- 1) A student of mass 50 kg climbed a flight of stairs 25 m high spending energy at a rate of 400 J every second.
 - a) What physical term stands for the rate of spending energy?
 - b) Calculate the work done by the student in climbing the stairs.
 - c) Calculate the time taken to climb the stairs.
 - d) State all the energy changes that take place as the student climbs the stairs. (7 marks)

- 2) The figure below shows a ray of light AB incident on the side OBC from inside a semicircular Perspex block. The critical angle for Perspex is 40° .

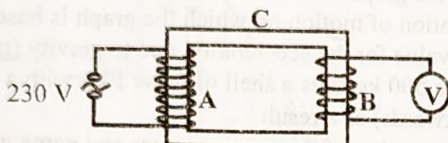


- a) What is meant by the underlined phrase?
 - b) Copy and complete the diagram to show the path of the ray after incidence. Give a reason for the diagram you have drawn.
 - c) What is the name of the effect produced?
 - d) Determine the refractive index of the Perspex block. (7 marks)
- 3)
 - a) Explain why the handle on a door is on the opposite side to the hinges of the door.
 - b) A bicycle can be steered by applying a pair of equal but opposite forces to the handlebars, which act as a lever.
 - i) What is meant by the term lever?
 - ii) Distinguish between moment of a force and couple.
 - iii) A cyclist's hands are placed 40 cm apart on the ends of the handlebars. To turn the bicycle, he applies a force of 20 N through each hand. Calculate the turning effect of the force.
 - iv) Name another device which is an application of a couple. (8 marks)
- 4)
 - a) Explain why it is more effective to cool cans of drinks by placing them in a bucket full of melting ice rather than in a bucket of water at an initial temperature of 0°C .
 - b) The diagram shows an apparatus used by a Visionary student to compare heat transfer in different metals.



- i) Name the method by which heat is transferred in metals.
 - ii) How can this experiment be used to find out which metal is the best at allowing heat transfer?
 - iii) State one way of making sure that this investigation is fair. (7 marks)

- 5) a) What is a semiconductor material?
 b) State two methods by which the conductivity of a semiconductor material can be improved.
 c) A semiconductor diode can be used as a rectifier.
 i) What is the function of a rectifier?
 ii) State the property of a diode that makes it useful in a rectifier circuit? (6 marks)
- 6) The diagram shows an electrical transformer which has two coils A and B wound on a laminated core C.



- a) State the basic principle of functioning of a transformer.
 b) Name a suitable material from which the core C should be made.
 c) Explain why the core is laminated.
 d) Part A has 400 turns of wire and part B has 1200 turns. Part A is connected to a 230 V a.c. supply. What is the voltage across part B? (5 marks)

SECTION II (1 ½ Hours)

Answer ALL questions, choosing one question from each pair of alternatives.

Answer EITHER 7 (a), (b) and (c) OR 7 (d), (e) and (f)

EITHER 7 (a), (b) and (c)

- 7) a) i) Define mechanical advantage and velocity ratio as used with machines.
 ii) State the condition under which mechanical advantage and velocity ratio would have the same value. (3 marks)
- b) In an experiment using a frictionless block and tackle pulley system to investigate the relationship between effort and load distance, the following results were obtained.
- | | | | | | | | |
|---------------------|-----|------|------|------|------|------|------|
| Load distance / m | 2.2 | 3.6 | 4.1 | 5.0 | 5.8 | 6.2 | 8.0 |
| Effort distance / m | 8.8 | 14.4 | 16.4 | 20.0 | 23.2 | 24.8 | 32.0 |
- i) Plot a graph of effort distance (y-axis) against load distance (x-axis). (5 marks)
 ii) Determine the gradient of your graph and state its physical significance. (3 marks)
- c) People working on the roofs of buildings often lay a ladder or plank of wood on the roof. They walk on the ladder rather than the roof itself.
 i) Explain why using a ladder or plank will help to prevent damage to the roof.
 ii) A workman's weight is 850 N, and each of his boots has an area of 210 cm^2 . Calculate the maximum pressure under his feet when he is walking.
 iii) State one health hazard due to pressure to humans and explain how it can be overcome. (7 marks)

OR 7 (d), (e) and (f)

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- 7) d) A body A moves with a uniform velocity of 10 m s^{-1} , while another body B moves from rest at the time with a uniform acceleration of 2 m s^{-2} . Define the underlined words. (2 marks)
- e) In an experiment to determine a value for the acceleration due to gravity (g), the time (t in seconds) for a steel ball to fall through various heights (h in metres) from rest was measured. The results of the experiment are given in the table below.

h/m	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7
t/s	0	0.14	0.21	0.25	0.29	0.32	0.35	0.38
t ² /s ²								

- Copy the table and complete the row for t^2/s^2 . (2 marks)
 - Plot a graph of h (on the y-axis) against t^2 (on the x-axis) and draw the best straight line from the origin through the points. (5 marks)
 - Find the gradient of the graph. (2 marks)
 - Write down the equation of motion on which the graph is based and use it with the gradient to obtain a value for the acceleration due to gravity (g). (2 marks)
- f) A stationary gun of mass 500 kg fires a shell of mass 1 kg with a velocity of 600 m s^{-1} and recoils (moves backwards) as a result.
- State the law of conservation of linear momentum and name another daily example where the law is observed. (3 marks)
 - Explain why the gun moves backwards. (2 marks)
 - Calculate the initial recoil velocity. (2 marks)

Answer EITHER 8 (a), (b) and (c) OR 8 (d), (e) and (f)

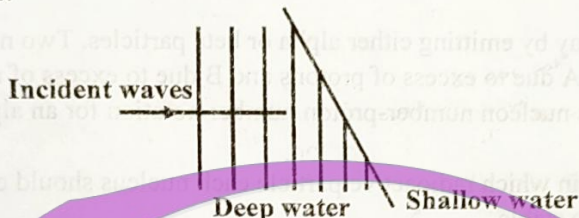
Answer EITHER 8 a, b and c

- 8) a) To calibrate a thermometer, a substance with a good thermometric property and two fixed points are needed.
- What is a thermometric property?
 - Name the thermometric property used in a mercury-in-glass thermometer.
 - Give one advantage and one disadvantage of mercury as a thermometric substance.
 - Define the lower fixed point and state its value on the Celsius temperature scale.
 - The lower fixed point and the upper fixed point on an uncalibrated thermometer are found to be 25 cm apart. What is the temperature in $^{\circ}\text{C}$ when the mercury thread is 15 cm above the lower fixed point? (8 marks)
- b) i) Define specific heat capacity. (2 marks)
- ii) Describe an experiment to measure the specific heat capacity of a metal block. Your description should include; the list apparatus required, the measurements you will make, how you would use the data from the measurements to get the specific heat capacity of the block and the precautions you will take to ensure accurate results. (6 marks)
- c) Explain why:
- A burn from steam at 100°C is more severe than a burn from boiling water at 100°C . (2 marks)
 - A glass bottle full of water and corked will crack if forgotten in the fridge for long. (2 marks)

OR 8 d, e, f and g

- 8) d) A sound wave can be produce by plucking on a guitar string.
- Differentiate between the sound wave and the wave on the guitar string itself.
 - Briefly describe three ways by which the frequency of the note produced by a gaiter can be increased.
 - Pitch and quality are two characteristics of a musical note. Name the physical property of sound waves on which each characteristic depends. (7 marks)

- e) Describe an experiment to measure the speed of sound in air. Your description should include: the list of apparatus required, the measurements you will make, how you would use the data to arrive at the speed of sound, the precautions you will take to ensure the accurate results. (6 marks)
- f) The figure shows plane waves travelling from a region of deep water to a region of shallow water.

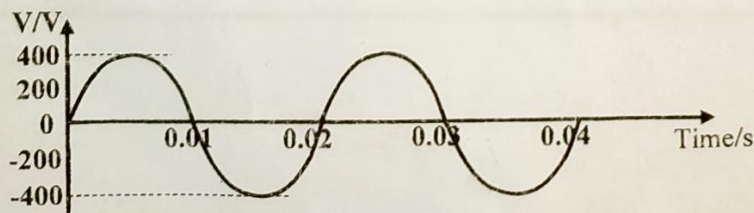


- i) Name a physical property of the wave which remain constant when the wave move from a region of deep water to a region of shallow water.
- ii) Copy and complete the diagram to show the appearance of the waves in the shallow water. (3 marks)
- Gamma rays, radio waves and infrared radiation are three electromagnetic waves.*
- iii) Classify them in order of increasing frequency.
- iv) For any one of these waves, state one source and one application of it. (4 marks)

Answer EITHER 9 (a), (b) and (c) OR 9 (d), (e) and (f)

Answer EITHER 9 a, b and c

- 9) a) i) Differentiate between an electrical conductor and an insulator.
- ii) Why is it difficult to charge an iron rod held in the hand by friction? (4 marks)
- A cloud discharges 400 C of charges into a lightning conductor during a thunderstorm releasing 2×10^8 J of energy. Determine:
- iii) The number of electrons that flow through the lightning conductor (Take the electronic charge, $e = 1.6 \times 10^{-19}$ C).
- iv) The potential of the cloud.
- v) The current flowing through the lightning conductor if the discharge lasted 0.2 s. (5 marks)
- b) An electric heater is rated 220 V, 1600 W. Visit www.alstug.com
- i) Define electrical resistance.
- ii) Determine the resistance of its heating element.
- iii) How much will the user pay to ENEO in the month of September if the heater is used for 45 minutes twice each day and if one unit costs 50 frs. (6 marks)
- c) The voltage of an a.c source varies with time as shown in the figure below.



Use the graph to determine;

- The peak voltage.
- The root mean square (rms) voltage.
- The frequency of the source.

(5 marks)

OR 9 d, e and f

9) d) Unstable nuclei decay by emitting either alpha or beta particles. Two nuclei A and B are known to be unstable, A due to excess of protons and B due to excess of neutrons.

- Write down the nucleon number-proton number notation for an alpha particle and a beta particle.
- State and explain which radioactive particle each nucleus should emit during decay to become more stable.
- Write an equation to show how a beta particle emitted during decay is produced from a neutron.
- State two properties of radioactive radiations giving a practical application of each property.

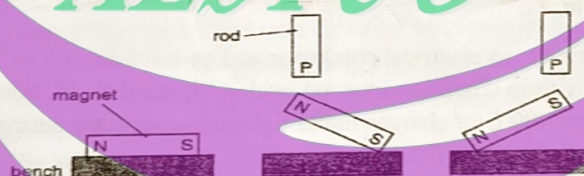
(8 marks)

e) Radioactive cadmium has a half-life of 6.7 hours.

- Explain the meaning of the underlined phrase.
- Calculate the fraction of the cadmium nuclides left after 20.1 hours.
- State one use of half-life of a named radioactive nuclide.

(6 marks)

f) The figure shows a magnet is placed on a bench and later the end P of a rod is held above each end of the magnet in turn.



- Suggest what material the rod is made from.
- Name the phenomenon illustrated in the figure when the rod is brought close to the bar magnet.
- Explain how the rod lifts each end of the magnet off the bench.
- Explain whether or not attraction is the true test of polarity of a magnet.

(6 marks)

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