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TERESA JANE REPETITION CLASSES

♦Edukamer

MOCK EXAMINATION .... FEBRUARY 2020	SUBJECT CODE NUMBER *780*	PAPER NUMBER *2*
ADVANCED LEVEL	SUBJECT TITLE *PHYSICS*	

Time Allowed: 2HOUR 30 MINUTES

SECTION I (ONE HOUR)
ANSWER ALL QUESTIONS IN THIS SECTION.

1) (a) Explain why the homogeneity of a physical equation is not a sufficient condition for the correctness of the physical equation? (3 marks)

(b) Faraday's law may be stated in the form, $E = -L\frac{dI}{dt}$, where, E, is the induced emf, L is the inductance of the coil and $\frac{dI}{dt}$ is the rate of change of current. Determine the base units of L, if the equation is homogeneous. (3 marks)

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2) A simple oscillating pendulum has as amplitude 0.05 m and period 2.0 s.

(a) Calculate the velocity of the pendulum as it passes through the equilibrium position. (2 marks)

(b) The expression for the displacement of the pendulum is $y = Asin\omega t$. Sketch a graph of acceleration a, against time t, for a complete oscillation. Note $a = -\omega^2 y$ (3 marks)

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3) Figure 1 shows how capacitors, X, Y, and Z are connected to a battery in an electric circuit.
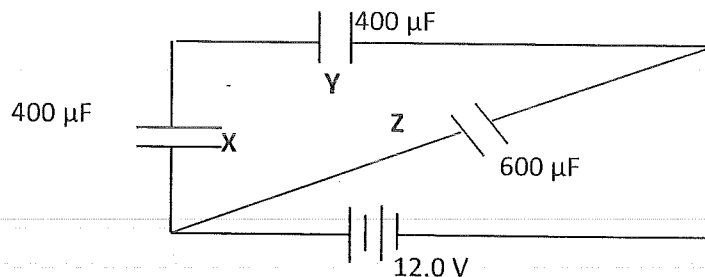

Figure 1

Calculate

a) Voltage across the capacitor Y (3 marks)

b)   Energy stored in the capacitor X   (3 marks)

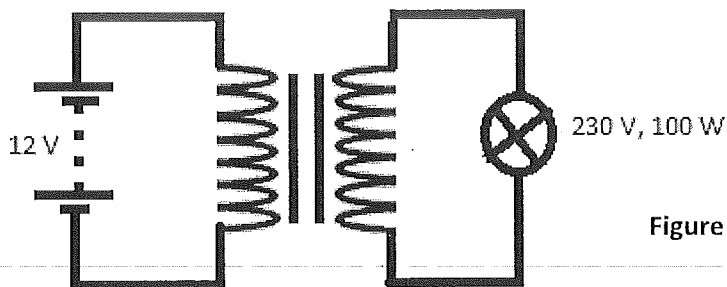4) (a) A transformer cannot be used to run a 230 V, 100 V mains lamp directly from a 12 V d.c car batter.

12 V

230 V, 100 W

Figure 2

Suggest in terms of fields and energy why the system cannot work
(b) (i) Discuss how the system can be adapted to function   (2 marks)
      (ii) What type of transformer does **Figure 2** represents?   (1 marks)

5)   **Figure 3** show a small spherical charged metal bob 50 g which initially hangs vertically between two conducting plates. When a potential difference of 12.0 V is maintained across the plates the thread makes an inclination of 30^0 to the vertical.

30^0

5.0 cm
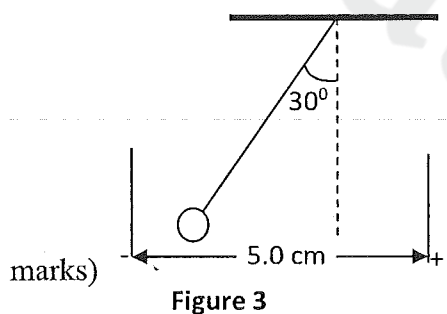
marks)

Figure 3

(a) Draw a free body diagram for the bob when the p.d is applied.
(b) Determine the charge on the bob

(6

6)   A beam of parallel light is incident normally on a diffraction grating having 550 lines per mm. A telescope is used to observe the second order in the spectrum. Calculate the angular separation in radians of two spectral lines of wavelength 559 nm and 563 nm.
                                                                              (4 marks)

Answer either questions 7 or question 8.

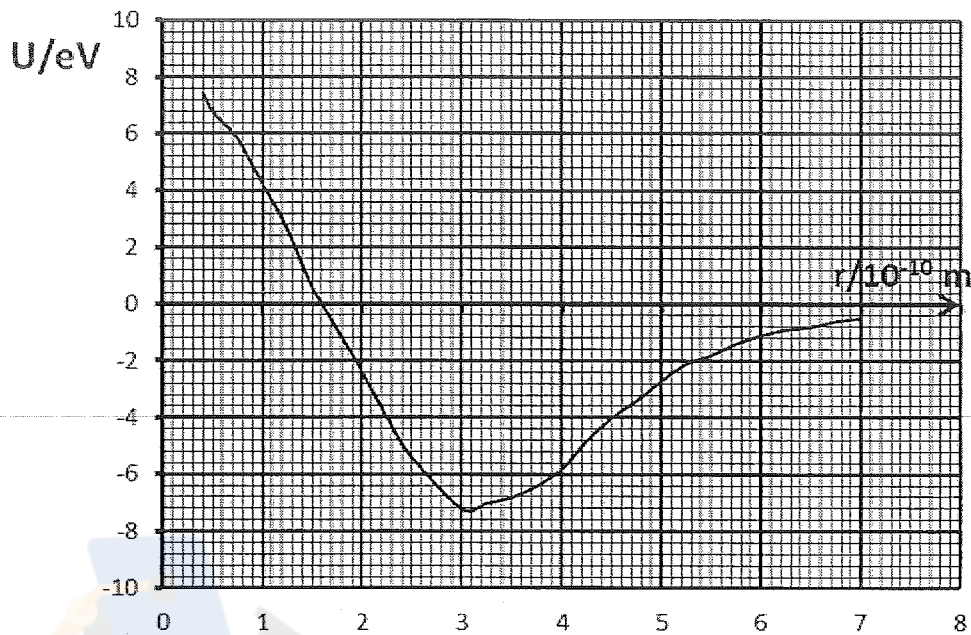7) (a) Figure 4 below shows how the potential, U, between two neutral atoms varies with their distance apart.

Figure 4

(i) What is the minimum potential energy in joules?

(ii) With reference to the graph, explain the expansion of solids

(iii) Determine slopes at the points where the r values are 11 nm, 38 nm and 67 nm.

(iv) Plot a graph of slopes above against r, estimate the energy needed to separate the atoms completely.

(b) Explain how electromotive force is different from potential difference.

8) (a) Define specific heat capacity. (2 marks)

   (b) Describe an experiment to determine the specific heat capacity of a metal. Your description should include a diagram, procedure, precaution, observation and conclusions. (8 marks)

   (c) An engine is used to raise an 800 kg of iron at a speed of 6.7 ms^{-1}. 0.5 kg of glycerin initially at room temperature of 23^{0}C is required every second to maintain the temperature of the engine bearing at θ. The power developed by the engine is 1.0 x 10^5 W. If the specific heat capacity of glycerin is 2.5 x 10^{3}Jkg^{-1}K^{-1}. Calculate the value of θ. (3 marks)

   (d) A well lagged aluminum calorimeter of mass 80 kg contains 150 g of water and 100 g of ice at 0^{0}C. A heating coil rated 1.0Kw is put in the calorimeter and the mixture stirred until its temperature is 33^{0}C.

i) Calculate how much ice is left after one minute.   ii) State two assumptions you have made. (5 marks)

   (e)   The *thermal conductivity of iron is 80W/mK*. What do you understand by this? (2   marks)

SECTION II: DATA ANALYSIS (30MINUTES) (COMPULSORY)

1.   An experiment was performed to investigate how the resistance of a material wire varies with the temperature. The following data was recorded.

Resistance/Ω	Temperature
330.0	10
340.0	20
350.0	30
360.0	40
370.0	50
380.0	60
389.0	70
400.0	80
410.0	85

Theory suggests that the resistance of the wire is related to its temperature by the expression, $R = R_0(1 + \alpha\theta)$, where R_0, is the resistance at a temperature, 0^0C, and α is a constant.

(a) Plot a suitable graph from which R_0 and α could be obtained.

(b) Use the graph to obtain the values of R_0 and α

(c) Say whether this material is a conductor or semiconductor.

SECTION III: OPTIONS
ANSWER ANY TWO QUESTIONS OF YOUR CHOICE

OPTION I: ENERGY RESOURCES AN ENVIRONMENTAL PHYSICS

8) (a) (i) Distinguish between renewable and non renewable energy sources giving an example of each

(ii) A solar panel delivers power of 2.0 kW when the rays of the sun fall normally on it. If the solar constant is 1.2×10^3 Wm^{-2} and its efficiency is only 40 %, calculate the area of the solar panel.

(b) (i) Explain why Cameroon cannot rely completely on the solar energy for its energy needs.

(ii) Draw an energy flow diagram for an energy scheme in which wood is burnt to produce electrical energy.

OPTION 2: COMMUNICATION

9)   (a) (i) Draw a basic block diagram of a mobile phone handset.   (4 marks)

(ii) Compare the use of optical fibres and copper cables in the transmission of information in terms of:

Security, Noise, and Signal attenuation   (6 marks)

(b) What is the full meaning of the following abbreviations?

- SIM
- SMS   (2 marks)

(c) Explain how a radio receiver works (3 marks)

OPTION 3: ELECTRONICS

(a) State in words and in the form of a truth table the actions of the following logic gates

(i) AND (ii) OR (iii) NAND (6 marks)

(b) Figure 5 shows a transistor circuit operating in the common emitter mode with a current gain of 60 and V_{BE} of 0.7 V.
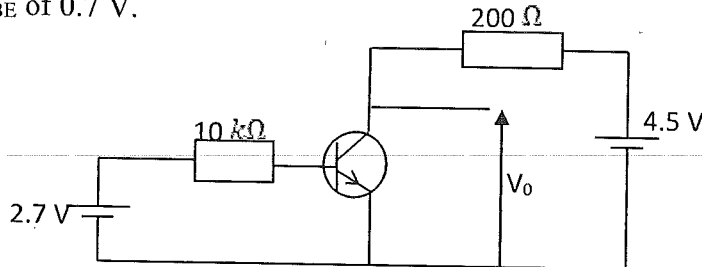

Figure 5

Calculate the output voltage, V_0. (4 marks)
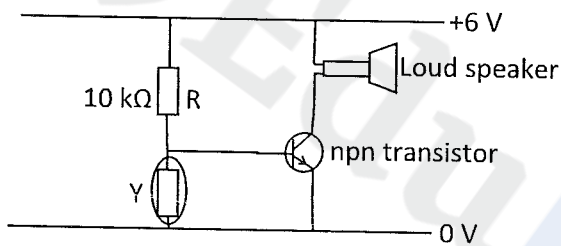
(c)

Figure 6

Figure 6 shows a simple alarm circuit.
The device Y could be a LDR.
Explain how this could be used to functions as an alarm
The resistance of the LDR in position Y for a given light intensity is 200 Ω. Explain whether the alarm in figure 4 will be on or not. (5 marks)

OPTION 4: MEDICAL PHYSICS

1. (a) (i) Draw and describe the basic structure of the human ear. (6 marks)
(ii) Consider the ear to be a pipe closed at one end, and that the length of the human auditory canal is approximately 28 mm. If the velocity of sound in air is 340 m/s then what is the frequency of the fundamental note in the ear? (3 marks)
(iii) The ossicles in the ear act as a lever. What does this mean? (2 marks)
(b) Optical fibres are considered to be the major breakthrough in many fields of study including medicine.
(i) State the concept under which optical fibres is very useful.
(ii) Draw a diagram under which optical fibre is very useful.
(iii) Describe an application of optical fibres in medicine. (4 marks)

GO BACK AND CHECK YOUR WORK