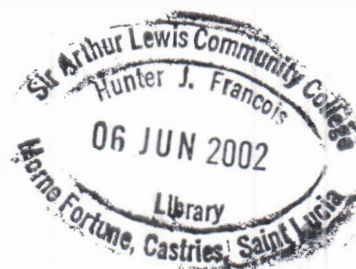


**SIR ARTHUR LEWIS COMMUNITY COLLEGE**  
**DIVISION OF TECHNICAL EDUCATION AND MANAGEMENT**  
**STUDIES**

EXAMINATION SESSION : May 2001 Examination  
TUTOR : Miss Toussaint  
PROGRAMME TITLE : Electrical / Mechanical Technician  
Electronic Service Technician  
Automotive Technician  
PROGRAMME CODE : 1 EMT  
**COURSE TITLE** : **Applied Engineering Science 1**  
COURSE CODE : ENS 317  
CLASS : Year 1  
DATE : 9<sup>th</sup> May, 2001  
TIME : 9:00 am  
DURATION : 3 Hours  
ROOM : TRT R1/ R2  
INVIGILATOR : Miss Toussaint / Mr. Preville



**INSTRUCTIONS:**

This Examination has four sections: -

Section A – MULTIPLE CHOICE (25 MARKS)  
Section B – FREE RESPONSE (52 MARKS)  
Section C - STRUCTURED QUESTIONS (43 MARKS)

**TOTAL 120 MARKS**



**TO OBTAIN 100%, YOU NEED 85 MARKS.**

**ANSWER ALL QUESTIONS IN ALL SECTIONS.**

- BEGIN EACH QUESTION ON A NEW PAGE, YOU MAY WRITE ON BOTH SIDES OF THE PAPER.
- NUMBER YOUR ANSWERS CAREFULLY.
- ALL WORKING (EXCEPT DIAGRAMS) SHOULD BE IN PEN.
- YOU ARE REMINDED THAT NEAT PRESENTATION IS ESSENTIAL.

**In this examination, unless otherwise stated, please use: -**

Speed of light in a vacuum,  $C = 3.00 \times 10^8 \text{ ms}^{-1}$

Speed of sound in air at  $20^\circ\text{C} = 343 \text{ ms}^{-1}$

Threshold of hearing (minimum intensity audible to the average person) =  $1.0 \times 10^{-12} \text{ Wm}^{-2}$

1 Atmosphere =  $1.013 \times 10^5 \text{ Nm}^{-2}$

**DO NOT TURN THIS COVER SHEET UNTIL YOU ARE TOLD TO DO SO.**

## **SECTION A**

**SECTION A HAS TWENTY-FIVE (25) MULTIPLE CHOICE QUESTIONS.  
PLEASE ANSWER ALL ON THE MULTIPLE CHOICE SHEET PROVIDED.**

1. A ray of light entering a lens of a camera changes direction. This effect is
  - A) diffraction
  - B) dispersion
  - C) refraction
  - D) restriction
  
2. If a real object is placed in front of a converging lens at various positions, which of the following kinds of images can it form?
  1. real, erect image
  2. inverted, magnified image
  3. erect, virtual image
  - A) 1 only
  - B) 1 and 2 only
  - C) 2 and 3 only
  - D) 1, 2 and 3
  
3. An object 2 cm high is placed 15 cm from a diverging lens of focal length 10 cm. The image is formed 6 cm from the lens. Its height is
  - A) 0.8 cm
  - B) 1.2 cm
  - C) 3 cm
  - D) 5 cm
  
4. Accommodation is the name of the process by which the human eye
  - A) adjusts the amount of light which reaches the retina
  - B) focuses images on the retina for near or distant objects
  - C) changes the curvature of the cornea
  - D) determines the colour of the light entering the eye
  
5. A sound wave is travelling vertically upwards. Which of the following is a possible direction for the oscillation of the molecules of air?
  1. up and down
  2. north and south
  3. east and west
  - A) 1 only
  - B) 2 only
  - C) 2 and 3 only
  - D) 1, 2 and 3
  
6. Physical properties shared by both light waves and sound waves are:
  1. both can be polarised
  2. both can be reflected
  3. both can be diffracted
  - A) 1, 2, 3 are all correct
  - B) 2, 3 only are correct
  - C) 1, 2 only are correct
  - D) 3 only is correct.

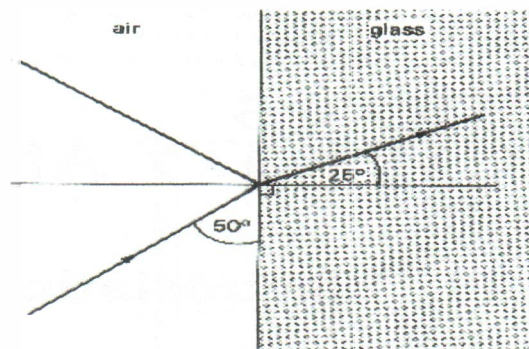


7. The wavelength of a wave-train shown in the figure above is represented by
  - A) QR
  - B) PS
  - C) SU
  - D) PT
  
8. Water waves in a ripple tank have a wavelength of 3.0 cm and amplitude of 1.0 cm. They travel at  $12 \text{ cm s}^{-1}$ . The frequency of the vibrator making the wave is
  - A) 3 Hz
  - B) 4 Hz
  - C) 12 Hz
  - D) 36 Hz

9. The interference experiment to show that light is a wave was first performed by  
 A) Young C) Huygens  
 B) Newton D) Foucault
10. Which of the following wave phenomena are exhibited by sound waves?  
 1. refraction  
 2. interference  
 3. diffraction  
 A) 2 only C) 2 and 3 only  
 B) 1 and 2 only D) 1, 2 and 3
11. A third order fringe of 650-nm light is observed at an angle of  $15^\circ$  when the light falls on two narrow slits. How far apart are the slits?  
 A)  $7.5 \mu\text{m}$  B)  $466 \mu\text{m}$   
 C)  $2.5 \mu\text{m}$  D)  $561 \mu\text{m}$
12. An organ pipe of length 0.8 m is an open tube. What are the first and second harmonic frequencies of the air in the pipe?  
 (Use the speed of sound in air as  $320 \text{ ms}^{-1}$ )  
 A) 100 Hz and 200 Hz C) 200 Hz and 600 Hz  
 B) 200 Hz and 400 Hz D) 200 Hz and 800 Hz
13. The intensity of sound is related to what physically measurable quality of the sound wave: -  
 A) frequency C) amplitude  
 B) wave-length D) speed
14. Which of the following frequencies is audible to the normal human ear?  
 1. 25 000 HZ  
 2. 5000 Hz  
 3. 500 Hz  
 A) 1 only C) 2 and 3 only  
 B) 2 only D) 1, 2 and 3
15. If you look at the word TOBAGO reflected in a plane mirror, you would see



16. Find the angle of reflection and the angle of refraction in the diagram shown below.



- |    | <i>Angle of reflection</i> | <i>Angle of refraction</i> |
|----|----------------------------|----------------------------|
| A) | $25^\circ$                 | $40^\circ$                 |
| B) | $50^\circ$                 | $25^\circ$                 |
| C) | $40^\circ$                 | $25^\circ$                 |
| D) | $40^\circ$                 | $65^\circ$                 |

17. It is better to paint a roof of a house in the Caribbean white rather than a dark colour because
- A) it refracts thermal radiation better
  - B) it absorbs infra-red radiation better
  - C) it reflects infra-red radiation better
  - D) It conducts heat away faster
18. According to the kinetic theory, a rise in the temperature of a gas is always related to an increase in the molecules'
- A) volume
  - B) pressure
  - C) separation
  - D) kinetic energy
19. Iced water at  $0^{\circ}\text{C}$  is allowed to stand until it warms up to room temperature,  $30^{\circ}\text{C}$ . The temperature rise is
- A) 30K
  - B) 54K
  - C) 273K
  - D) 303K
20. A boy sees a flash of lightning and starts his stop watch. He stops the watch when the thunder is heard and reads 6 s. Approximately how far away was the thunder cloud?
- A) 0.5 km
  - B) 1 km
  - C) 2 km
  - D) 5 km
21. If the amount of air in a car tire is doubled the pressure is also doubled. This is an application of
- A) Boyle's law
  - B) Charles' law
  - C) The pressure law
  - D) None of the above
22. A vessel with a movable piston contains 3 litres of oxygen at a pressure of  $4 \times 10^5\text{ Pa}$ . When it is cooled to  $27^{\circ}\text{C}$ , its volume becomes 2 litres and the pressure  $2 \times 10^5\text{ Pa}$ . The initial temperature of the oxygen was
- A) 354 K
  - B) 373 K
  - C) 900 K
  - D) 1173 K
23. A suitable unit for specific latent heat is
- A)  $\text{W kg}^{-1}$
  - B)  $\text{J kg}^{-1}$
  - C)  $\text{J K}^{-1}$
  - D)  $\text{J kg}^{-1} \text{K}^{-1}$
24. The theory that all molecules have some kind of motion is called the
- A) caloric theory
  - B) Kinetic theory
  - C) Brownian theory
  - D) Rumford theory
25. Some water is spilled on the laboratory floor and not mopped up. Which process could cause the puddle to disappear after a time?
- A) boiling
  - B) convection
  - C) diffusion
  - D) evaporation

## FREE RESPONSE

Name: \_\_\_\_\_ Programme: \_\_\_\_\_ Year: \_\_\_\_\_

1.

- a) With reference to the atomic structures explain how p-type and n-type semiconductor materials are formed. [2 marks]

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- a) Describe the behaviour of a pn junction when
- i. Forward biased. [1 marks]
  - ii. Reversed biased [1 marks]

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- c) Give two applications of the pn junction. [2 marks]

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- d) Explain the operation of a bi-polar transistor. (4 marks)

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- e) Give two application of the bi-polar transistor. (2 marks)

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- f) Explain any one of the application described above. (2 marks)

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**TOTAL 14 MARKS**

2. (a)  $98.6^{\circ}\text{F} = \text{-----}^{\circ}\text{C}$  [1 mark]

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$-15^{\circ}\text{C} = \text{-----}^{\circ}\text{F}$  [1 mark]

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(b) What is meant by the critical temperature of a substance? [2 marks]

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(c) What is the ideal gas law? [1 mark]

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(d) If 55.0 L of oxygen at  $18.0^{\circ}\text{C}$  and an absolute pressure of 2.45 atm are compressed to 48.8 L and at the same time the temperature is raised to  $50.0^{\circ}\text{C}$ , what will the new pressure be?

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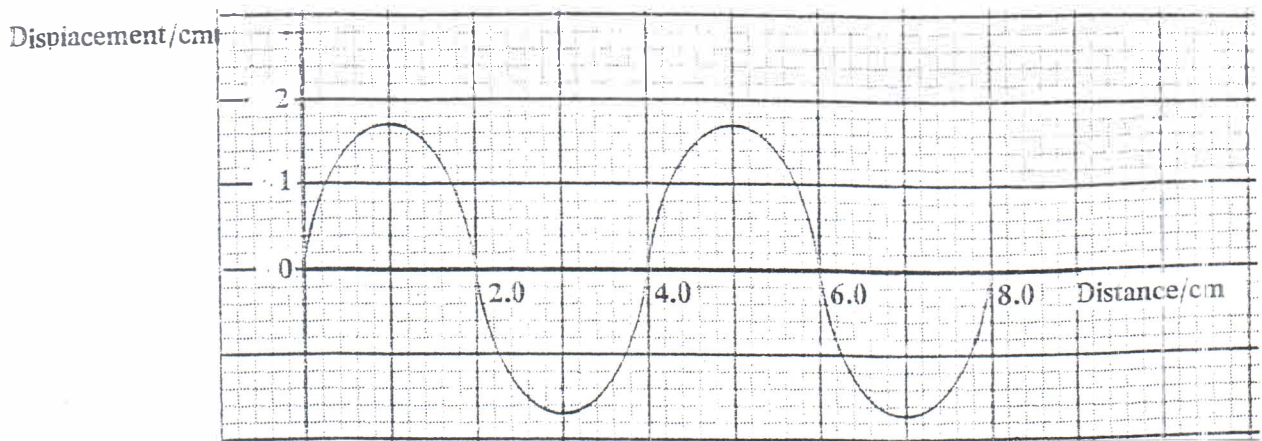


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[5 marks]

**TOTAL 12 MARKS**

3. The figure below is a transverse wave on a string vibrating with a frequency of 100 Hz.



(a) State the amplitude and wavelength of the wave.

Amplitude ----- [1 mark]

Wavelength ----- [1 mark]

(b) Calculate the velocity of the wave. [2 marks]

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**TOTAL 4 MARKS**