Student's name:……………………………….

2010
Preliminary Test
Semester 1

Freshwater Senior Campus-2010
Half yearly Examination
Mark Hamilton-teacher

Engineering Studies

General Instructions	Section I
	Total marks 40
• Working time (one period)	
• Board approved calculators may be used	**Section II**
• Write using black or blue pen	Total marks 48
• Draw diagrams using pencil	
• Write your student number and/or name at the top of every page	**Section III**
	Total marks 12

This paper MUST NOT be removed from the examination room

Formulae which may be used in this test:

Dynamics
- $F = ma$
- $W = mg$
- $Pressure = F/A$

Electronics
- $E = IR$
- $P = EI$

Strength of materials
- $\sigma = P/A$

Area of a circle
- $A = \pi d^2/4$

Circumference of a circle
- $C = \pi d$

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Section I   (40 marks -2 marks each)

Select the alternative A, B, C, or D that best answers the following twenty questions and indicates your choice by circling the letters in front of the appropriate responses.

1.   A Newton is the unit of force derived from the SI system. It is equal to the amount of force required to accelerate a mass of one kilogram at a rate of one metre -

(A) Per second
(B) Per second per second
(C) per second per second per second
(D) per second per second per second per second

2.   The major rotating part in an induction electric motor is called the:

(A) terminator
(B) armature
(C) commutator
(D) brushes

3.   Materials which can readily be elongated by being passed through a die are said to be:

(A) high tensile materials
(B) malleable
(C) tough
(D) ductile

4.   The ability of a material to be hammered and rolled into thin sheets is called:

(A) hardness
(B) elasticity
(C) toughness
(D) malleability

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5.   A measure of the quantity of electrons flowing per second is known as:

(A) resistance
(B) electricity
(C) current
(D) Potential difference.

6.   What is the resultant force in the following diagram?

(A) 17.83 N
(B) 22.14 N
(C) 16.17 N
(D)   9.41 N

7.   High resistance in electronic components can:

(A) cause the component to cool down
(B) restrict the flow of protons through the component
(C) act like a dam and build up an electronic charge
(D) cause less electrons to flow in a circuit.

8.   The quantity of current passing through an electrical conductor is measured in:

(A) volts
(B) millimetres
(C) ohms
(D) amperes

9.   Condensation polymerisation occurs when:

(A) monomers in plastic are squashed together by force and heat
(B) polymer molecules are long-chain and linear molecules, without cross-linking, as the result of monomers combining together
(C) monomers link together with secondary bonds and a by-product such as water vapour may be given off
(D) when the formation of thermo-softening polymers is reversed so that the polymer cannot be melted

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10.   Brazing involves the use of:

(A) strengthening a joint with brass
(B) melting the parent metals and a filler to go in the joint
(C) cleaning off oxides before heating the joint to below melting
(D) joining steel and aluminium together with adhesives.

11.   Vector systems which are in equilibrium:

(A)   have all horizontal moments equal to zero
(B)   have all torque opposing the vertical and horizontal forces
(C)   have no moments
(D)   have the sum of horizontal and vertical forces opposing each other

12.   The basic SI unit for measurement of length is a:

(A)   centimetre
(B)   metre
(C)   inch
(D)   millimetre

13.   The unit used to quantify e.m.f. is:

(A)   amperes
(B)   ohms
(C)   volts
(D)   farrads

14.   A heater running on 240 volts draws 9 amps of current. What will the heaters power be?

(A)   12.51 kw
(B)   9.32 kw
(C)   2.16 kw
(D)   6.01 kw

15.   Materials which resist scratching and indentation are said to be:

(A)   soft
(B)   hard
(C)   tough
(D)   rigid

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16. The formulae for OHMS Law is:
    (A) E=IR
    (B) R=IE
    (C) I=RT
    (D) RI=ET

17. A chemical mixture:

    (A) has a combination of at least three elements
    (B) has elements combined in fixed proportions
    (C) relies on covalent bonds
    (D) can physically be separated into its basic elements

18. Mechanical properties of materials include:

    (A) impact strength, compressive strength, hardness, density
    (B) mass, density, porosity, toughness
    (C) the sectional area of a sample divided by its length
    (D) toughness, scratch resistance, torsional strength, bend resistance

19. Materials which are covalently bonded are:
    (A) easily broken down chemically
    (B) less likely to melt because they are metallic
    (C) good conductors of heat and electricity
    (D) better insulators even in wet conditions

20. The action of a force can be moved along its line of action. This is the:
    (A) force can be applied in an equal and opposite direction
    (B) way equilibrium is used
    (C) principle of transmissibility
    (D) force can be moved laterally from its point of application

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Section II   Household Appliances (60 marks)

The illustration below shows a simplified toaster. The toaster's sizes are:
- Overall height – 200mm
- Overall width – 150mm
- Overall length – 250mm
- Bread slot opening – 40mm x 150mm (so that crumpets can be toasted)
- Space between slots – 30mm
- Depth of bread slot - 170mm
- Thickness of ends – 30mm
- Recess in ends – 20mm deep x 130mm wide x 150 mm high
- Distance down from top surface to top edge of end recess - 10mm
- Vertical slot for slide control – 10mm wide x 130mm high
- Top of vertical slide control slot - 20mm down from top surface
- Handle for slide control – 10mm high and 20mm x 110mm
- Distance down from top surface to top edge of slide control-handle – 30mm
- Heat/timer control knob - ϕ 20mm x 10mm axis length
- Centre for heat/timer control knob– 20mm up from bottom and 30mm in from edge
- Main body depth – 180mm

ENDS

TOP EDGE OF RECESS IN END

HANDLE FOR SLIDE CONTROL

VERTICAL SLIDE CONTROL SLOT

HEAT/TIMER CONTROL KNOB

MAIN BODY

A
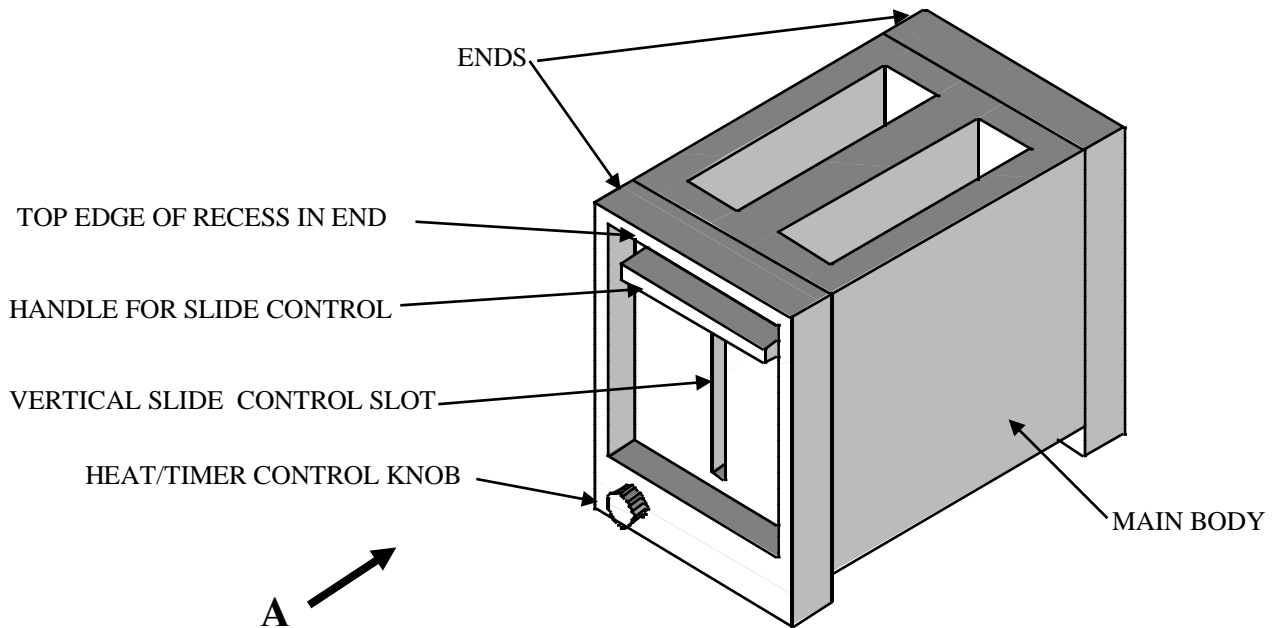
Question 21 (2 marks for each response)

(a) What is the approximate volume of the toaster in metres cubed? (show working)

……………………………...

(b) What sheet metal would be suitable for the main body fabrication in the toaster?

……………………………………………………..

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(c) Give two special properties which are needed for the material used in the toaster's element?

………………………………………. , …………………………………….

(d) What safety device in the switchboard could be used to protect an operator from electric shock?

…………………………………………………………………………….

(e) What causes the element to cook the toast?

……………………………………………………………………………………..

(f) Various metals are used in the manufacture of toasters. What are three characteristic properties of metals?

…………………………………………….....................................

………………………………………………......................................

(g) The toaster's parts could be made from ferrous and non-ferrous metals. What is the difference between a ferrous and non-ferrous metal?

……………………………………………………………………………………..

(h) Continued cyclic heating and cooling could eventually cause failure of the element. What is the name given the type of failure caused by repeated cyclic loading of components?

....

(i) During normal operation the toaster components are not subjected to loads which cause permanent deformation. If any components do distort under load, they are likely to return to their original size after removal of the load. What is the name of the property of a material which allows permanent deformation when loads are applied?

....

(j) Draw an orthogonal drawing by freehand in the space provided.

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(k) Draw the symbols and state the functions of the electronics components listed below.

| 10 marks |

Symbols

Resistor …………………………………………..

…………………………………………………

Battery …………………………………………..

…………………………………………………

Capacitor …………………………………………..

………………………………………………..

Cross wire ……………………………
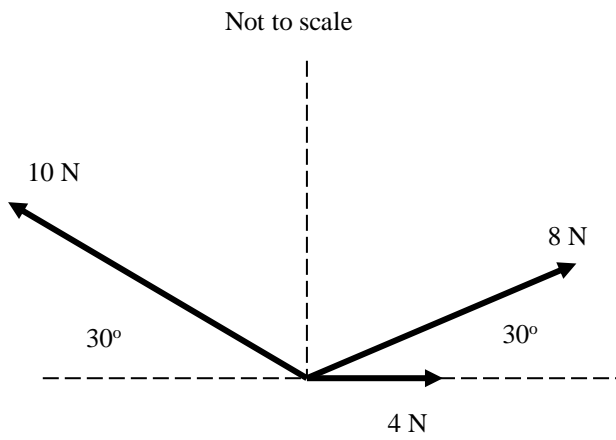
…………………………………………………

Diode ………………………………………….

…………………………………………………

(l) How does an induction motor with a squirrel cage work? (3 marks)

(m) How does a combustion motor work? 3 marks.

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(n)   Find the resultant x component and the resultant y component of the force system s (8 marks)

Not to scale

10 N

8 N

30º   30º

4 N

(n) A battery powered drill has a total resistance of 10   .If the potential difference is 7.2 volts, what will be the current? (4 marks)

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Section III   Materials (12 marks – two for each response)

Question 22. (2 marks each)

a) What is the main chemical element in organic materials?

   ………………………...........................

b) What distinguishes "hardwoods" from "softwoods"?
   ……………………………………………………………………………

c) Name a ceramic …………………………………………………..

d) Describe the following:
   i.   Metallic bonding ………………………………………………….
   ii.   Ionic bonding …………………………………………………..

e) Explain what is meant by the following:
   i.   Ductility   …………………………………………………
   ii.   Hardness   …………………………………………………

f) Explain, with the aid of sketches, the structure of atoms. (2 marks)

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End of paper