Coimisiún na Scrúduithe Stáit
State Examinations Commission

TECHNOLOGY

Junior Certificate Examination, 2004
HIGHER LEVEL
200 Marks
Wednesday, 23rd June, Afternoon, 2:00 to 4:00

SECTION A

INSTRUCTIONS

1. Answer Section A (short answer questions).   100 marks
2. Answer either (a) or (b) from each question in Section B.   50 marks
3. Answer one question from Section C.   50 marks
4. Hand up this paper at the end of the examination along
   with answer sheets for Section B and C.

MARKING SCHEME

Centre
Number

Examination
Number

For Examiner	
Total Mark	
Question	**Mark**
Section A	
Section B Q1 (a)	
(b)	
Q2 (a)	
(b)	
Section C Q3	
Q4	
Q5	
Q6	
Total	
Grade	

MAKE SURE TO WRITE YOUR EXAMINATION NUMBER IN
THE BOX PROVIDED ON THIS PAGE

1. Explain the <u>function</u> of each of these computer paint program icons.

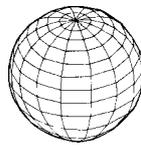   (i)

   (ii)

   (i): fn: (to) erase, remove, delete, etc
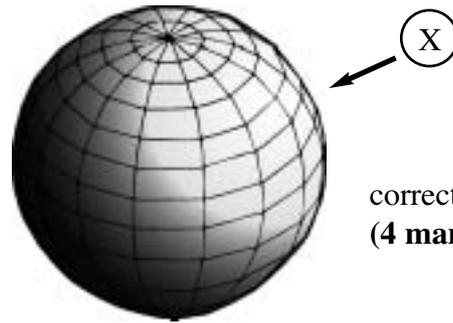   **(2 marks)**

   (ii): fn: to fill (with colour)
   (2 marks)

   must be 'function'
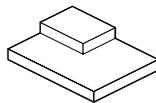
2. Shade the sphere shown to suggest a light source at X.
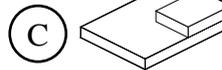

   Origional

   X

   correct shading
   (4 marks)

3. Which one of the figures labelled A, B or C is another view of figure X?

   A

   B

   C

   X
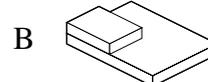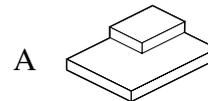
   Answer: C *or* marked
   (4 marks)

4. State the meaning of the following abbreviations:

   (i)   WWW

   (ii)   RAM

   WWW: World wide web
   (2 marks)

   RAM: Random Access Memory
   (2 marks)

5. What does each of the symbols shown represent?

   (i)   (ii)

   (i): Recycle / Reuse
   (2 marks)

   (ii): Wear a (safety) mask
   (2 marks)

6. Name the material used on the handle of a pliers

   and

   state a reason for this choice of material?

   Material: Plastic or named plastic or rubber
   (2 marks)

   Reason: Issues relating to - Insulator / Grip
   (2 marks)

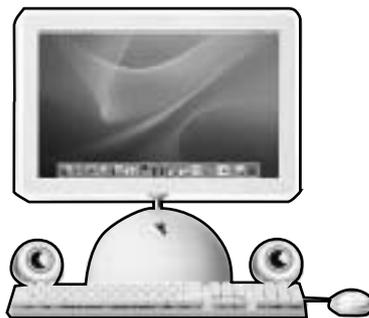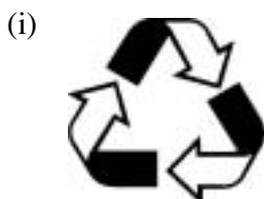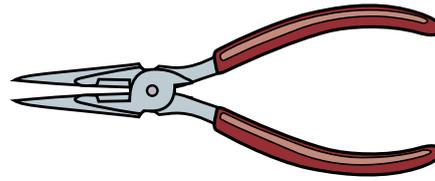7. State **two** precautions which should be taken when drilling acrylic to prevent the material shattering.
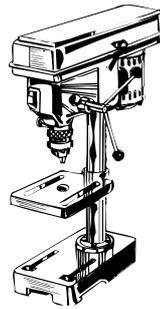
   (i): 1st valid precaution
   (2 marks))

   (ii): 2nd valid precaution
   (2 marks)

   Safety goggles, no loose hair/clothes, clamp workpiece, remove chuck key, wood under workpiece, drill slowly, etc.

8. Name the tool shown

   and

   name a material which can be shaped using this tool.

   Tool: Hot wire cutter
   (2 marks)

   Material: Polystyrene (aeroboard)
   (2 marks)

9. Calculate the force applied to the nut in the nutcracker shown.

   20N
   100mm
   50mm
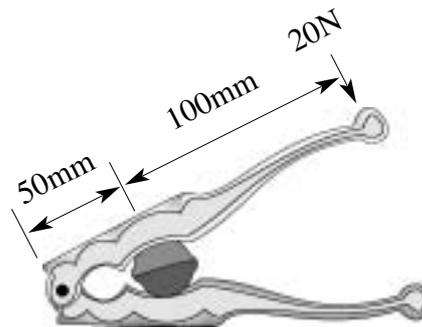
   Force: <u>60</u> (N) **(4 marks)**

   150(mm) x 20(N) = 50(mm) x X(N)
   (2 marks) **-** *formula*

   (150x20)/50
   (1 marks)
   60(N)
   (1 marks)

10. Name the manufacturing process used to make this plastic carton.
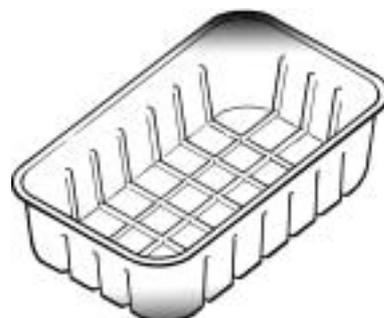
    Process: Vac forming
    (4 marks)

11. Name the parts of the transistor labelled X, Y and Z.

X

Y

Z
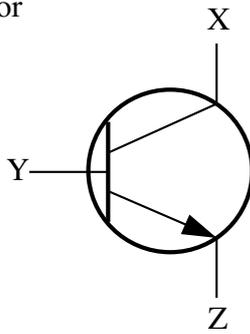
X: Collector

Y: Base

Z: Emitter

1st correct - **(2 marks)**
2nd correct - **(1 mark)**
3rd correct - **(1 mark)**

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12. Complete the truth table for the AND gate shown

A ——
B ——
C
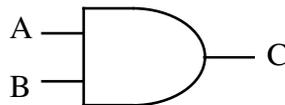
A	B	C
1	1	**1**
1	0	**0**
0	1	**0**
0	0	**0**

(4 x 1 marks)

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13. Name the electronic components represented by the symbols shown.

(i)
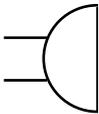
(ii)

+
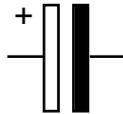
(i): Buzzer
   (2 marks)

(ii): Capacitor
   (2 marks)

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14. Complete the wiring of the double pole double throw (DPDT) switch used to control the direction of rotation of the motor.

Motor

Battery

DPDT switch
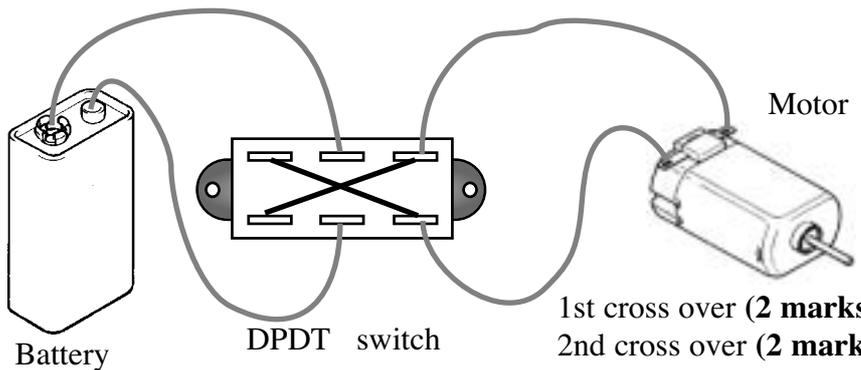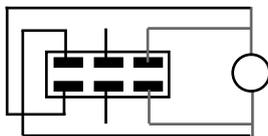
1st cross over **(2 marks)**
2nd cross over **(2 marks)**

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15. Calculate the resistance of R in the circuit diagram.

R

A

V) 6V

12mA
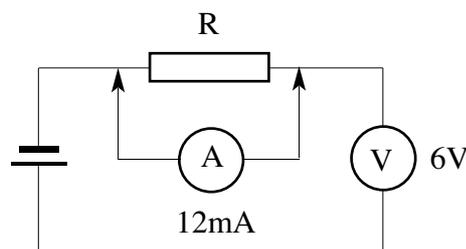
Resistance: <u>500</u> (*Ohms*)
   (4 marks)

V/I =R or V=IR   *(2 mark)*
(6/0.012)=R   *(2 marks)*
500(Ohms)   *(2 marks)*
6/.12 or 6/12   *(2 marks)*

16. Name the forces applied to the beams in 'X' and 'Y' shown.

Y

X
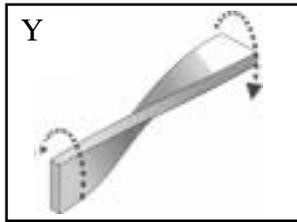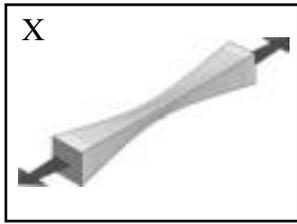
X: Tension   Alt-Stretch
   (2 marks)   *(1 mark)*

Y: Torsion   Alt-*Twisting*
   (2 marks)   *(1 marks)*

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17. Name the mechanisms shown.

(i)   (ii)
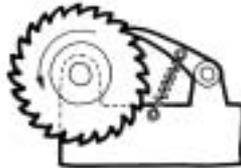
(i): Bevel gears
   (2 marks)

(ii): Ratchet & Pawl
   (1 + 1 marks)

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18. Sketch **two** possible cross sections for the members in the frame shown to minimise the load.
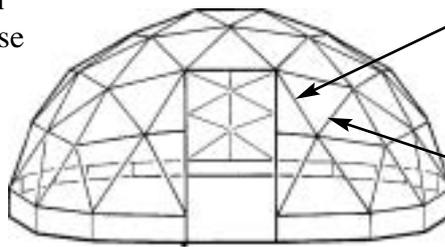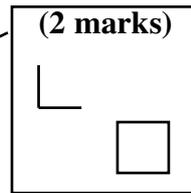
Cross section 1:   *Hollow&*
   (2 marks)   *structural*

Cross section 2:
   (2 marks)

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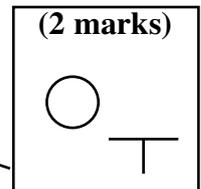
19. State **two** advantages of toothed belts over chains in computer printers and plotters.
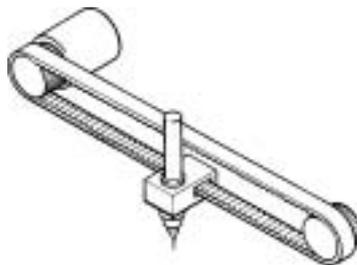
Advantage1: **(2 marks)**
Advantage2: **(2 marks)**

Quiet, easier to replace/fit, lubrication not required, lower cost/weight, can slip, accuracy, etc.

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20. Calculate the output speed in the gear train shown.

12T   12T

Driver
Input speed
18RPM

40T   40T   40T
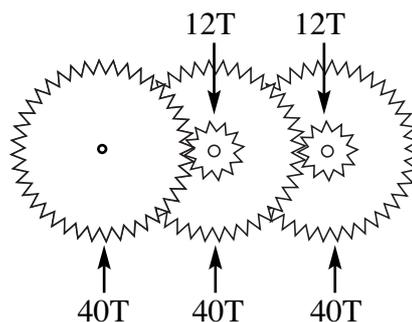
Driven: Output speed

Output speed: 200(RPM)
   (4 marks)

18(RPM) x 40T=12T x 60(RPM)
(2 marks)   *formula (1 mark)*
60(RPM) x 40T=12T x 200(RPM)
(2 marks)   *formula (1 mark)*

21. State **two** ways in which technology can be used to help the disabled in the home.

(i): 1st valid ans. - **(2 marks)**
(ii): 2nd valid ans. - **(2 marks)**

Lift (stair/bath, etc.), alarms, remote control of devices, etc.

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22. Name **one** synthetic material

and

name **one** natural material used in footware.

Synthetic: 1 x named material
(2 marks)
PVC, Gortex, Nylon, etc.

Natural: 1 x named material
(2 marks)
leather, rubber, cotton, etc.

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23. Give **two** reasons why additives are placed in processed food.
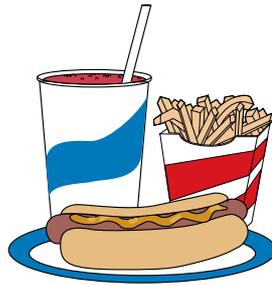
(i): 1st valid ans. - **(2 marks)**
(ii): 2nd valid ans. - **(2 marks)**

Flavour (enhancers), colouring, preservatives, anti-oxidants, etc.

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24. State **two** ways in which a modern motorcar can be made 'eco-friendly'.

(i): 1st valid ans. - **(2 marks)**
(ii): 2nd valid ans. - **(2 marks)**

Fuel (energy) efficient, less-emissions, parts recycled, biodegradable, electric/solar power, rechargable, etc.

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25. State **two** energy conversions taking place in the generator.
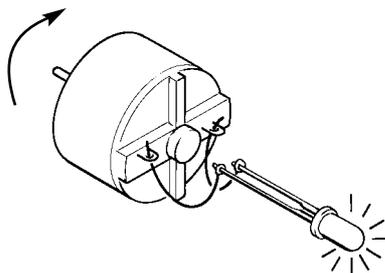
(i): 1st valid ans. - **(2 marks)**
(ii): 2nd valid ans. - **(2 marks)**

Kinetic (1 mk) to heat (1 mk), kinetic to electric, kinetic to light, magnetic, mechanical, etc.

26. State **two** reasons why an '*investigation of possible solutions'* should be carried out as part of the design process for a toy.
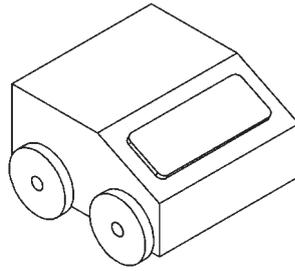
(i): 1st valid ans. - **(2 marks)**
(ii): 2nd valid ans. - **(2 marks)**

Investigate (find) :
other design ideas,
alt mechanisms, electrics,
shapes, popular toys, safety
issues, finishes etc.

27. State **two** advantages of a microprocessor controlled sewing machine over a traditional sewing machine.
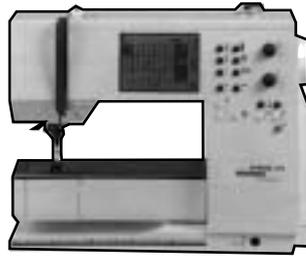
(i): 1st valid ans. - **(2 marks)**
(ii): 2nd valid ans. - **(2 marks)**

Pattern reproducable (accurate),
programmable, faster, complex
designs, cost effective, etc.

28. State **one** advantage

and

one disadvantage to the use of plastics in packaging.

Plastic egg carton

Advantage: 1 x **(2 marks)**

easily manufactured, transparent,
low cost, durable, air-tight, etc.

Disadvantage: 1 x **(2 marks)**

not easily recycled, wasteful of a
limited resource, etc.

29. State the contribution made by any **two** of the following to the development of modern transport.

(a)   Henry Ford
(b)   Wright brothers
(c)   George Stephenson

Name:
Contribution: correct contribution
2 x (2 marks)

(a)   Henry Ford - mass production
(b)   Wright bros. - powered flight
(c)   George Stephenson -(Rocket) passenger rail transport

30. Name **two** manufactured boards

and

state **one** advantage to these boards over natural timber.
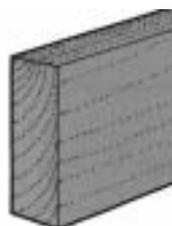
Board 1: named **(1 marks)**
Board 2: named **(1 marks)**

Advantage: **(2 marks)**

Lower cost, reduce usage of
natural timbers, no knots,
uniform structure (strength),
easier to work (machine),
range of sizes, shapesetc.

31. Complete the isometric sketch of the door stopper shown.

Isometric view
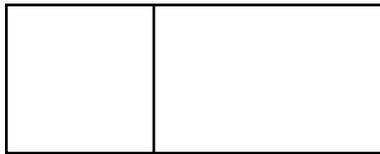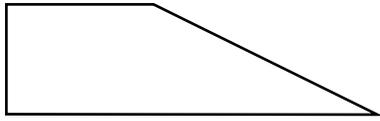
(2 marks)

(2 marks)

Orthographic view
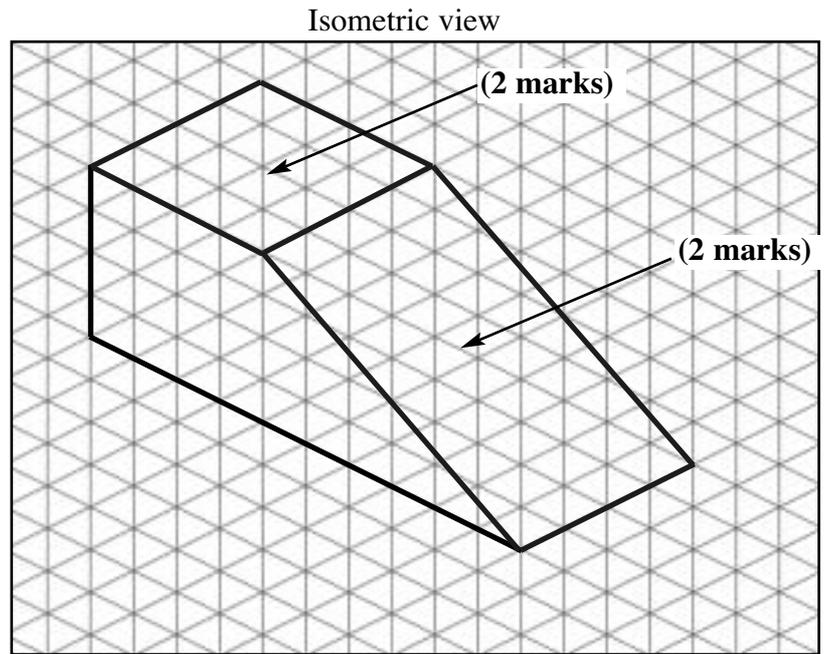
32. What are the values of the dimensions 'A' and 'B' on the diagram below?

70

150

R30

100

B

R30

60

A: 30   **(2 marks)**

A
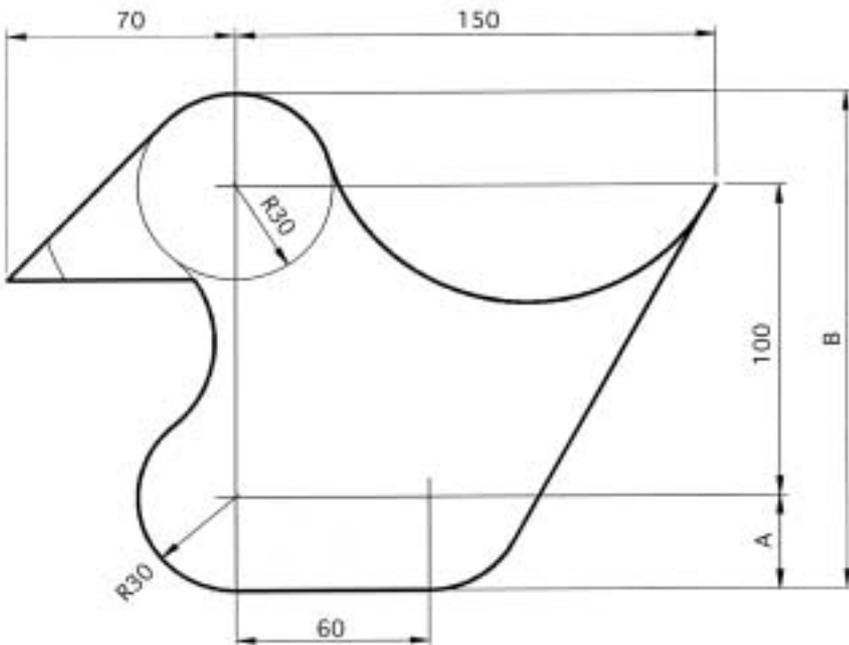
B: 160   **(2 marks)**

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State Examinations Commission

TECHNOLOGY

Junior Certificate Examination, 2004

HIGHER LEVEL

200 Marks

Wednesday, 23rd June, Afternoon, 2:00 to 4:00

SECTION B and SECTION C

SECTION B - 50 Marks
SECTION C - 50 Marks

MARKING
SCHEME

INSTRUCTIONS

1. Answer either (a) or (b) from each question in Section B.

2. Answer one question from Section C.

3. Make sure to hand up Section A with your answer sheets to this paper.

1 (a)   *The sketch shows a design for a domestic weighing scales.*
          The scales will be manufactured from acrylic and hardwood.

(i)   *Using a suitable scale draw:*
        1. An **elevation** *looking in the direction of arrow* '**X**'.   **[5 marks]**
               Correct elevation view (2 marks),
               all elevation proportions correct (3 marks)
               (-1 for each incorrect proportion (max 3))
        2. An **end elevation** *looking in the direction of arrow* '**Y**'.   **[5 marks]**
               Correct elevation view - must include curved edges (2 marks),
               all elevation proportions correct (3 marks)
               (-1 for each incorrect proportion (max 3))
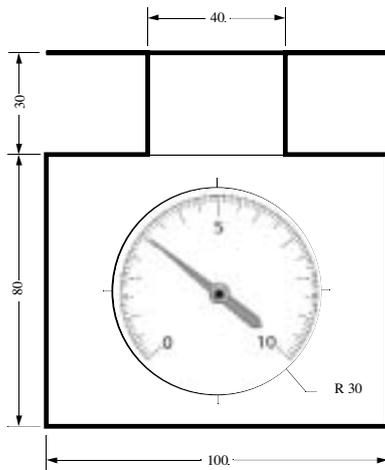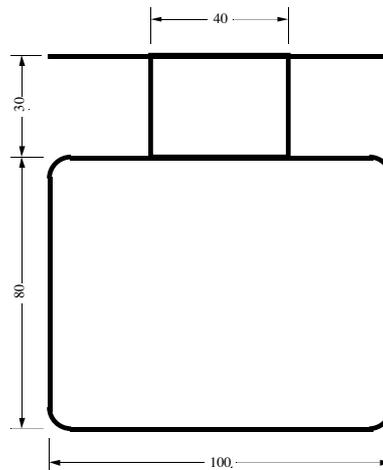
X   Y

(ii)   *1.Sketch a suitable design, in isometric view, of a bowl to fit on the scales.* **[3 marks]**

            Suitable design (2 mark) in isometric view (1 marks)

        2.Indicate clearly on your **design a feature** *which will prevent your*
         bowl from slipping off the scales.   **[2 marks]**

            Sketch of suitable design feature (2 marks)

(iii)   *1.Sketch a design for a mechanism which will move a dial attached*
         to the front face to indicate the number of grammes on the bowl.   **[5 marks]**

            Suitable mechanism (2 mark)   ex: rack & pinion
            Quality of sketch (1 - 3 marks)

        2.Include a mechanism in your design which will return the dial to the
         zero mark when the load in the bowl is removed.   **[5 marks]**

            Suitable mechanism (2 mark) ex: spring
            Quality of sketch (1 - 3 marks)

1 (b) *The sketch shows a design of a wall mounted acrylic box used to hold coupons.*
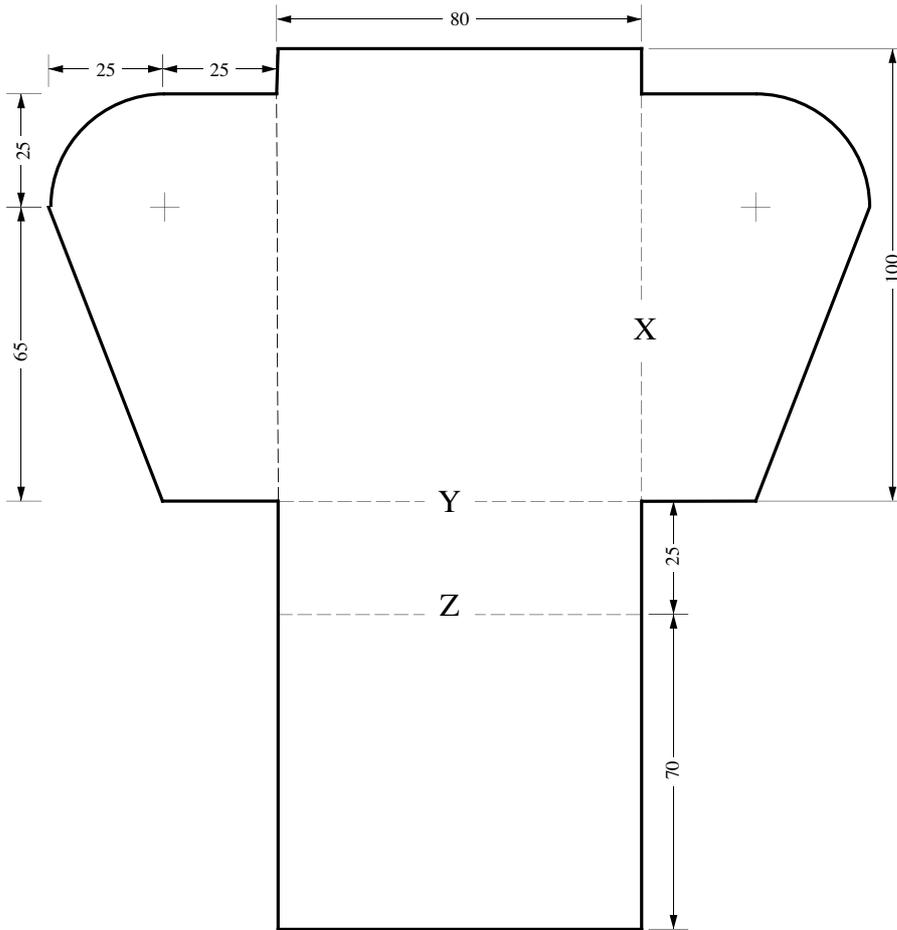
(i)   *Using a suitable scale, draw a development of the coupon box.*
       Indicate clearly all bend lines and show all dimensions.   **[10 marks]**

> **Correct development - (1 x back, side, base & front) (4 marks)**
> **Bend lines shown as broken lines - X,Y,Z (3 x 1 marks)**
> **Dimensions shown - 80, 100 & 70 (3 x 1 marks)**

(ii)   *1. State **two** reasons why acrylic is a suitable choice of material*
       from which to manufacture the box.   **[5 marks]**

> **1st correct reason (3 marks)** : attractive finish, easily bent/shaped, etc.
> **2nd correct reason (2 marks) : hard wearing, will not rust,**

2. Indicate clearly the steps you would take to manufacture the
   box from a sheet of acrylic. Name all equipment required.   **[5 marks]**

> **2 correct steps (2 + 1 marks)** : mark-out, cut, bend,etc.
> **2 appropriate tools (2 x 1 marks)** :

(iii) *Indicate clearly the steps you would take to produce a smooth polished edge to the acrylic.*
                                                                                 [5 marks]

> **1st correct step (3 marks)** : cross file, draw file, steel wool, wet/dry sand, polish
> **2nd correct step (2 marks)**

2 (a)   *A student is required to produce a circuit which will turn on a water pump when low water levels are detected by a sensor. The components listed below are available to construct the circuit.*

(i)   *1. Using the **sensor** and the **variable resistor**, sketch the <u>circuit diagram</u> for the **potential divider** required in this circuit.*   **[4 marks]**
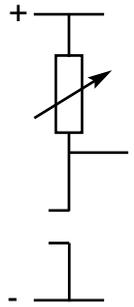
Potential divider correct (2 marks) power lines missing (-1 mk)
VR symbol correct (1 mark)
Sensor symbol (gap) (1 mark)

2. Name and explain your choice of material for the sensor.   **[2 marks]**

Name : conductor eg **<u>metal</u> contacts with gap (1 mark)**
Explain : **water bridges gap, completes circuit, low R, circuit off**
            : **no water, open circuit, high R, circuit on (1 mark)**

3. Explain why a variable resistor is used in the potential divider.

: allows sensitivity of circuit to be adjusted   **[2 marks]**

4. Indicate clearly which pins on the variable resistor should be used in the potential divider.   **[2 marks]**

: 2 pins identified (outside + middle pins) (1 + 1 marks)
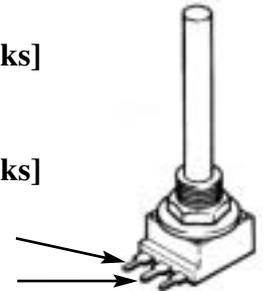
(ii)   *1.   Using the appropriate component symbols, sketch the complete circuit diagram required to control the pump.*   **[6marks]**

In the circuit diagram:

Correct circuit diagram (1 mark)
Correct position of 2k2 and transistor (2 marks)
Correct position of potential divider (2 marks)
Correct position of motor (1 mark)
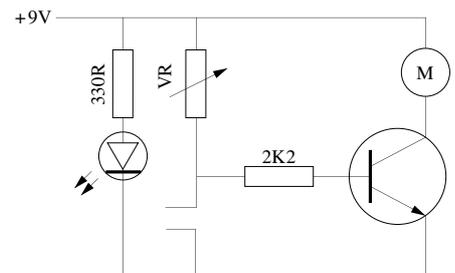
2.   A lighting LED is required to show the circuit is active. Include the LED in this circuit.   **[4 marks]**

Correct symbols - LED (1 mark), Resistor 330R (1 mark)
Correct location - in series between power lines (2 marks)

(iii)   *If the only water pump available contained a 12V motor, name the additional component required to turn on the pump. Explain briefly how this component works.*
          [5 marks]

Component : **Relay (3 marks)**
Explain : **Coil energised, electromagnet created, switch closed, (2 marks)**

2 (b) The sketch shows a student design for a mechanism to control the temperature in a coldframe by opening or closing the roof.

(i) *1.* *Name the <u>mechanisms A and B</u>.* **[4 marks]**

A: Worm (gear) (2 marks)
B: Rack (2 marks)

2. *State <u>two</u> advantages in using mechanism A in this situation.* **[4 marks]**

Advantage 1: Speed reduction, cannot slip, small size, etc. (2 marks)
Advantage 2: increased torque, etc. (2 marks)

3. *Explain why limit switches should be used with this system.* **[2 marks]**

Explain: Prevent damage to motor / gears
Stop motor at correct position (2 marks)

(ii) *Using the info. on the simplified sketch of the gear mechanism below:* **[10 marks]**

1. *Calculate the speed of gear C.* **5** *(RPM)* **(6 marks)**

800RPM(worm A) will rotate the 40T @ <u>20</u>RPM (20 x 40 = 800) (3 marks)
10T x <u>20</u>RPM = 40T(C) x <u>5</u>RPM (3 marks)

2. *Calculate the distance moved by B in 15 seconds.* **10cm (4 marks)**

40T gear @ <u>5</u>RPM will advance the rack by 200T/minute (5 x 40) (2 marks)
rack will advance 50T in 15sec. (200÷4 =50) (1 mark)
rack will move <u>10</u>cm in 15sec (50T÷5T/cm) (1 mark)

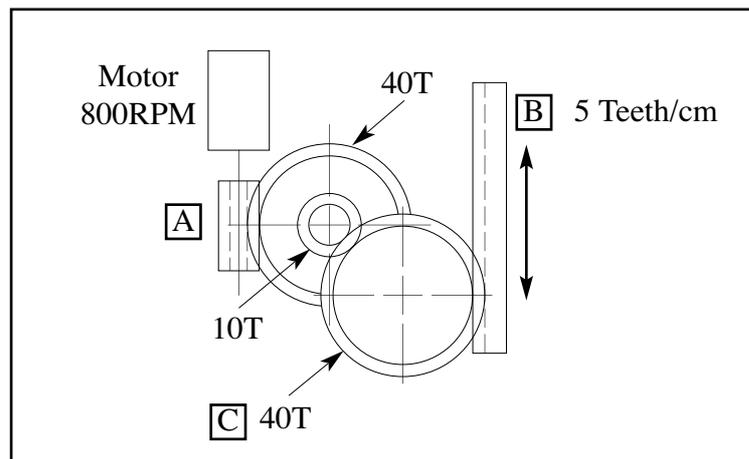(iii) *Sketch and name the components of an alternative mechanism to open and close the coldframe roof.* **[5 marks]**

Valid alternative mechanism sketched: (1 - 3 marks)
Components in sketch correctly named (2 x 1 marks)

Section C - 50 Marks

Answer **one** question from this section - all questions carry equal marks.

This section relates to **Technology & Society, Control Systems** and **Design & Manufacture**.

3.   **Technology and Society**

*Mobile communications technologies (mobile phones, etc.) have
increased in popularity in recent years.*   **[20 marks]**

(a)   *(i)*   *Name **two** features available in mobile phones not
found in older phones, as shown.*

1st valid feature : (3 marks) LCD screen, txt msg, music, etc.
2nd valid feature : (3 marks)

(ii)   *Explain any **two** technological developments which were
necessary before mobile technology could be brought into general use.*

1st development stated : (1 mark), development explained (2 marks)
2nd development stated : (1 mark), development explained (2 marks)
- Development of necessary electronics, infrastucture., etc.

(iii)   *State the role of **each** of the following in the development of mobile phones:*
1st valid role : (1 - 3 marks), 2nd valid role: (1 - 3 marks),
3rd valid role: (1 - 2 marks)

Role of designers, - any valid aspect of phone shape /design
Role of engineers, - any valid role in engineering chips / infra. str.
Role of programmers - any valid role in programming of phone system.

In Ireland, we have traditionally relied on fossil fuels as our main energy source.   **[20 marks]**

(b)   *(i)*   *Name **three** fossil fuels used in Ireland.* **(3 x 2 marks)**

- Coal, Peat, Oil, Gas

(ii)   *State **two** effects of fossil fuels on the environment.* **(2 x 2 marks)**

Pollution - Smog / Acid Rain / Oil Spillage, Greenhouse gas, etc.

(iii)   *Name **three** alternative sources of energy available in Ireland.* **(3 x 2 marks)**

Wind, Hydro, Wave, Tidal, Solar(!), Thermal

(iv)   *Name **two** ways in which technology can help reduce our energy
consumption in the home.* **(2 x 2 marks)**

Any two valid methods - Insulation, Electronic (timer, etc.) control, etc.

(c)   *Explain, using **two** suitable examples, how new technologies have changed
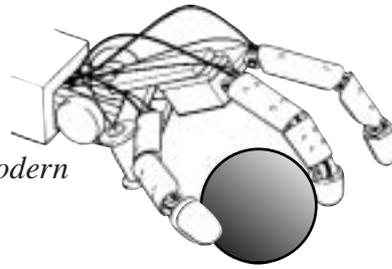home entertainment systems.*   **[10 marks]**

1st Named Technology (2 marks) DVD, Video, Remote control, etc.
Technology explained (1 - 3 marks)

2nd Named Technology (2 marks)
Technology explained (1 - 3 marks)

4.   **Control Systems & Technology and Society**

Pneumatic and robotic control are commonplace in modern manufacturing industries.   **[50 marks]**

(i)   *Explain, using **two** examples, why robots are used in manufacturing industry.*

1st example stated (2 marks), explained (1 - 3 marks)
2nd example stated (2 marks), explained (1 - 3 marks)

- ex: Assembly lines, explained: accurate / programmed / 'non-stop' production, etc.

(ii)   *Explain the function of **control software** and a **computer interface** in robotic control.*

Control software function explained (1 - 5 marks),
- function: software to operate robot / control movements / analyse feedback / etc.

Computer Interface explained (1 - 5 marks)
- function: provide connections between computer and robot, etc.

(iii)   *Explain why **feedback** is an important part of robotic control.*

Importance of feedback (1 - 5 marks)
- precision positioning, check if movements out of alignment, prevent 'mistakes', etc.

(iv)   *Explain what is meant by **pneumatic control**.*

Pneumatic control (1 - 5 marks)
- use of compressed air to move / control etc., actions of robot.

(v)   *Name **two** areas, other than manufacturing industry, where robotic control is used and outline the function of the robots.*

1st named use (2 marks), function outlined (1 - 3 marks)
2nd named use (2 marks), function outlined (1 - 3 marks)

- Use: exploration of planets, function: remote sampling / analysing, etc.
- Use: bomb disposal, function: safe examination of device, etc.

(vi)   *Explain, giving **two** appropriate reasons, why computer controlled manufacturing is more likely to be found in First World countries.*

1st reason stated (2 marks), reason explained (1 - 3 marks)
2nd reason stated (2 marks), reason explained (1 - 3 marks)

- Reason:
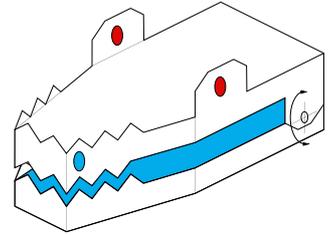**Infrastructure (Industry / Investment / Educational, etc.) not available / unstable,**
- Explained:
Computer controlled manuf. expensive set up,
Low labour costs do not justify computer controlled manuf. etc.,

5.   Design and Manufacture

The sketch shows a design for an animated dragon's head.

(a)   **[20 marks]**

(i)   Name two materials from which the head could be manufactured.

1st named material (2 marks) - plastic or named plastic, plywood
2nd named material (2 marks) - metal or named metal, cardboard

State one advantage and one disadvantage to each material.

Relevant associated advantages (2x2 marks)
Relevant associated disadvantages (2x2 marks)

(ii)   Outline the steps required to manufacture the head from one of these materials.

2 steps outlined (2 x 4 marks):

-1st appropriate manufacturing method for named material (2 marks)
- manufacturing method outlined (1 - 2 marks)
-2nd appropriate manufacturing method for named material (2 marks)
- manufacturing method outlined (1 - 2 marks)

(b)   **[30 marks]**

(i)   Sketch a suitable mechanism which will allow the upper jaw of the head to <u>open and close</u> approximately once every minute.

Appropriate mechanism to open (1 - 3 mks) and close (1 - 2 marks)
Quality of sketch (1 - 3 marks)
Consideration given to timing (1 - 2 marks)

(ii)   Sketch a suitable circuit and mechanism which will activate red LEDs in the eyes and a green LED in the mouth when the jaw is fully open.

Appropriate circuit / mechanism (1 - 5 marks)
Quality of sketch (circuit diag.) (1 - 3 marks)
Activated when jaw fully open (1 - 2 marks)

*(iii)   Sketch a design for a mechanism which will cause a fabric tongue to move when the mouth opens.*

Appropriate (circuit) mechanism (1 - 5 marks)
Quality of sketch (1 - 3 marks)
Activated when mouth open (1 - 2 marks)

6. Control Systems

A block diagram for a system to control a heater in a four cage tropical bird house is shown.
The system will turn on a heater (H), to keep the birds warm at night.
S1 will produce a logic state of '0' when cold and S2 will produce a
logic state of '0' when dark.
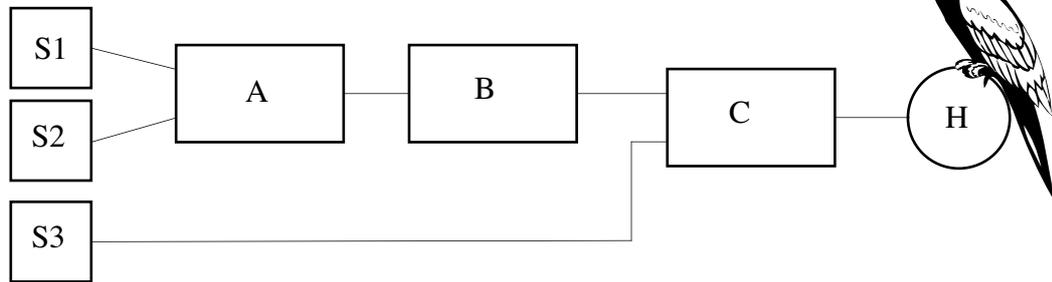
(a) **[15 marks]**

    (i)   *Name the electronic components required at sensor S1 and at sensor S2.*

         S1: Thermistor / temperature dependant resistor (3 marks)
         S2: LDR / light dependant resistor / ORP12 (3 marks)

    (ii)   *Identify the logic gates required at A, B and C.*

         A: OR Gate (2 marks)
         B: NOT Gate (2 marks)
         C: AND Gate (2 marks)

    (iii)   *Explain what will happen in this system if switch S3 is in the 'off' position.*

         Heat (H) will be off (3 marks).

(b)   *Sketch a design for a modification to the system shown which will:*   **[20 marks]**

    (i)   *sound an alarm if <u>any one</u> of the four cages is left open,*

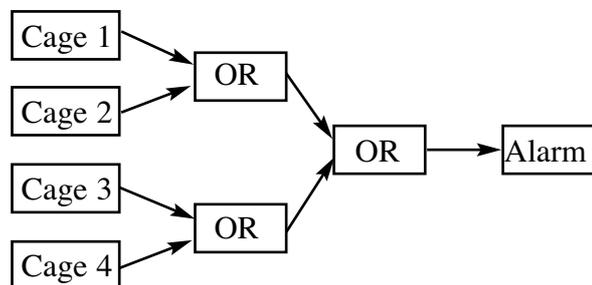   **Satisfactory modification :**

         Inputs identified
         (4 x 1 marks)
         - NO switch, etc.

         Valid processing identified
         - OR gates, etc. (4 marks)

         Valid design (2 marks)

(ii)   *automatically turn off the heater if the cages are open.*

Satisfactory modification

Inputs identified (4 marks)
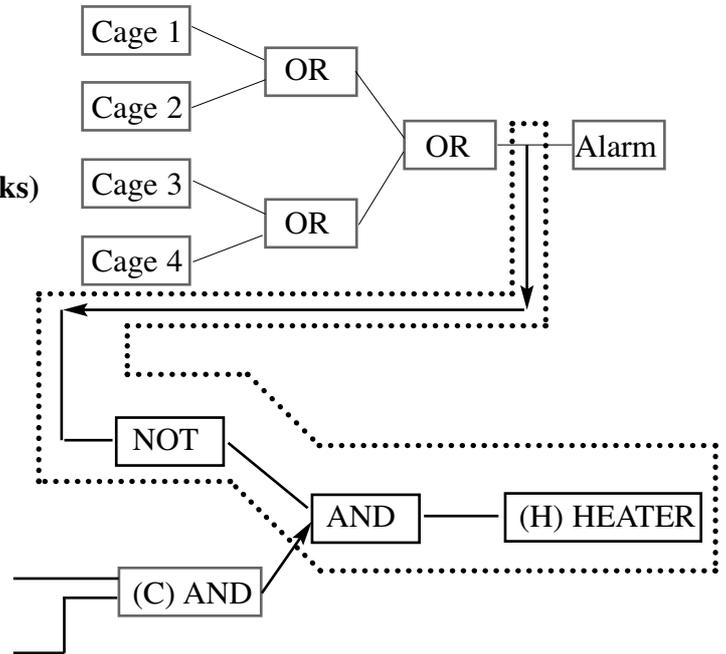**- connection to prev. mod.**

Valid processing identified
- Appropriate gates. (4 marks)

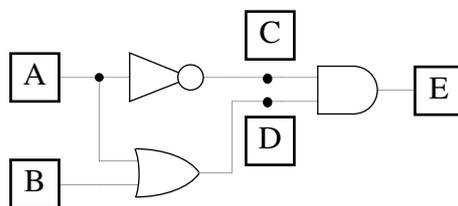**Valid design (2 marks)**

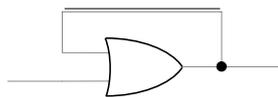*(c)*   **[15 marks]**

(i)   *Copy and complete the truth table for the gate arrangement shown below.*

A	B	C	D	E
1	*1*	**0**	**1**	**0**
1	*0*	**0**	**1**	**0**
0	*1*	**1**	**1**	**1**
0	*0*	**1**	**0**	**0**

Correct values placed in table: 12 x 1 marks

(ii)   <u>Name</u> *the gate arrangement shown below and suggest <u>one use</u> for this arrangement.*

Gate : Latch (2 marks)   Use : Alarms, etc. (1 mark)