

Rewarding Learning

General Certificate of Secondary Education 2011

Technology and Design

## Unit 1: <br> Technology and Design Core

[GTD11]

## WEDNESDAY 25 MAY, AFTERNOON

## TIME

1 hour.

## INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer all eleven questions.
On page 3 we have provided formulae for you to use with this paper.

## INFORMATION FOR CANDIDATES

The total mark for this paper is 90 .
Quality of written communication will be assessed in question 11. Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

| For Examiner's <br> use only |  |
| :---: | :---: |
| Question <br> Number | Marks |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |
| 7 |  |
| 8 |  |
| 9 |  |
| 10 |  |
| 11 |  |
| Total <br> Marks |  |

PLEASE NOTE:
On page 3 we have provided formulae for you to use with this paper.

Questions for this paper begin on page 4.

## Formulae for GCSE Technology and Design

You should use, where appropriate, the formulae given below when answering questions which include calculations.

1 Potential Difference $=$ current $\times$ resistance $(V=I \times R)$

2 For potential divider

$$
V_{2}=\frac{R_{2}}{R_{1}+R_{2}} \times V_{T}
$$



3 Series Resistors

$$
R_{\mathrm{T}}=R_{1}+R_{2}+R_{3} \text { etc }
$$

Parallel Resistors

$$
\frac{1}{R_{\mathrm{T}}}=\frac{1}{R_{1}}+\frac{1}{R_{2}} \quad \text { or } \quad R_{\mathrm{T}}=\frac{R_{1} \times R_{2}}{R_{1}+R_{2}}
$$

4 Gear ratio of a simple gear train $=\frac{\text { number of teeth on driven gear }}{\text { number of teeth on driver gear }}$
For a compound gear train:
Total Gear ratio $=$ the product of the gear ratios of all the subsystems
i.e. $G R_{\mathrm{T}}=G R_{1} \times G R_{2} \times G R_{3} \ldots$

5 Mechanical Advantage $=\frac{\text { Load }}{\text { Effort }}$

6 Velocity Ratio $=\frac{\text { Distance moved by effort }}{\text { Distance moved by load }}$

7 Pneumatics
Force $=$ Pressure $\times$ Area $(F=P \times A)$

8 Time Constant $T=R \times C$

1 Table 1 shows a number of different symbols. Using the first row as a guide, complete the table.

Table 1

| Sketch of Symbol | Type of Symbol | Name of Symbol |
| :---: | :---: | :---: |
|  | Electronic | Bulb |
|  |  | LED |
|  |  |  |
|  |  | Flammable |
|  | Computer Control |  |
| $\frac{7}{7}$ | Electronic |  |
| $V$ |  |  |

2 Fig. 1 shows a typical school CNC machine. CNC machines are totally enclosed compared to manually operated machines that do a similar job.


Fig. 1
© Boxford Ltd
(a) List three safety features of a CNC machine.

Safety feature 1:
$\qquad$
Safety feature 2:
$\qquad$
Safety feature 3 :
$\qquad$
(b) Other than safety, list two advantages in manufacturing products using a CNC machine compared with manufacturing the same products manually.

Advantage 1:
$\qquad$
$\qquad$

Advantage 2:
$\qquad$
$\qquad$

3 Fig. 2 shows a cam and follower.


Fig. 2
(i) Select a word from the list below to describe the motion of the follower.
Reciprocating Linear Rotary Oscillating
(ii) Which component produces the output motion?
(iii) Select the correct name for the cam from the following.

$$
\text { Eccentric } \quad \text { Heart shaped } \quad \text { Pear shaped }
$$

(iv) The cam turns until the point $\mathbf{A}$ is in contact with the follower. Determine the direction and distance moved by the follower.
$\qquad$
$\qquad$
$\qquad$

4 Fig. 3 shows a plastic holder for leaflets in a library. The holder is attached to a wooden notice board using screws which pass through the inserts.


Fig. 3
(i) State one specification point which should be considered in designing the leaflet holder.
$\qquad$
(ii) Suggest a suitable plastic material for the holder and give one reason for your choice.

Material $\qquad$
Reason $\qquad$
(iii) What equipment would be used to bend the material into the shape illustrated in Fig. 3?
$\qquad$
$\qquad$
(iv) Give one reason for using inserts as shown in Fig. 3.

Reason

5 (a) Table 2 shows five electronic circuit symbols. Name the four remaining electronic circuit symbols in Table 2 below.

## Table 2

| BULB |  |  |  |
| :--- | :--- | :--- | :--- |

(b) Insert all five symbols, shown in Table 2, into the part completed circuit diagram (Fig. 4) illustrated below. When the diagram is complete the bulb should switch on when there is a change in temperature.


## BLANK PAGE <br> (Questions continue overleaf)

6 (a) Table 3 shows the symbols for methods of operation of valves.

## Table 3

| Symbol | Name of symbol |
| :---: | :---: |
| Qo |  |
| $\square$ |  |
| $\square$ |  |
| $\square$ |  |
| $\square$ |  |
| Q |  |

Complete Table 3 by inserting the correct name for each symbol from Table 4.

Table 4

| Plunger |
| :---: |
| Roller trip |
| Lever |
| Push button |

(b) Fig. 5 shows part of a pneumatic circuit which is used to apply brakes to a wheel.

Fig. 5

Complete Fig. 5 to show how the brakes could be applied.



7 Fig. 6 shows a drawing of a metal component for a school project. The component part is to be made from brass sheet 2 mm thick.


Fig. 6
(i) Is brass a ferrous or non-ferrous metal?
$\qquad$
(ii) Why are alloys of metals formed?
$\qquad$
$\qquad$
(iii) Name the tool used to mark the centre of the hole in the metal component at end $\mathbf{A}$ to help drilling.
$\qquad$
(iv) Suggest a suitable finish that could be applied to the metal component.
$\qquad$

8 (a) Two basic circuit drawings are shown in Fig. 7 and Fig. 8 below.

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Fig. 7
Fig. 8
(i) Which circuit bulb would you expect to glow brighter?
$\qquad$
(ii) Explain your answer.
$\qquad$
$\qquad$
(b) Fig. 9 shows a slightly modified version of the circuit shown in Fig. 8.

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Fig. 9
(i) Name the component labelled A in Fig. 9.

Component A
(ii) Explain how this component works in this electronic circuit.
$\qquad$
$\qquad$
(iii) Suggest one possible use for this electronic circuit.
$\qquad$
(iv) Draw a circuit diagram for Fig. 9 in the space below. Label each electronic symbol used in your circuit.

9 (a) Fig. 10 shows the head of a robot. The eyes of the robot are to be controlled by two electric motors $A$ and $B$.

When the sensor in the nose of the robot is covered, both eyes rotate in a clockwise direction for 4 seconds. The program then stops.


Fig. 10

Complete the flowchart in Fig. 11 to show the process.


Fig. 11
(b) The program in question $9(\mathrm{a})$ is to be changed so that when the sensor is covered motor $A$ comes on for 3 seconds.

Then motor B comes on to rotate the other eye for 3 seconds. The program then stops.

Complete the flowchart in Fig. 12 to show this process.

## START

Fig. 12

10 (a) Fig. 13 shows a bracket which is used to support a hanging basket.


Fig. 13
(i) Name a suitable material for the bracket.
$\qquad$
(ii) Suggest a suitable finish for the bracket.
$\qquad$
(iii) State a suitable permanent method for joining the two parts at $\mathbf{A}$.
$\qquad$
(iv) Give one reason why a semi-permanent method may not be suitable for joining the parts at $\mathbf{A}$.
(b) Fig. 14 shows a different design for the bracket.


Fig. 14
(i) State a semi-permanent method for joining the parts at $\mathbf{B}$.
(ii) Explain why a semi-permanent method may be suitable for joining the parts at $\mathbf{B}$.
$\qquad$

11 Pneumatic systems use the energy stored in compressed air to do the work. By controlling the supply of the air to pneumatic cylinders, movement can be produced. Describe how you would construct a pneumatic circuit using a platform and discrete components. In your answer make reference to the attachment of the components to the platform, the connection of the piping and the testing of the circuit. Include any specific safety precautions for this process.
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