

**Wednesday 22 May 2013 – Afternoon**

**GCSE DESIGN AND TECHNOLOGY  
Electronics and Control Systems**

**A514/02** Technical Aspects of Designing and Making: Pneumatics

Candidates answer on the Question Paper.

**OCR supplied materials:**  
None

**Other materials required:**

- A calculator may be used

**Duration:** 1 hour 15 minutes



Candidate forename		Candidate surname	
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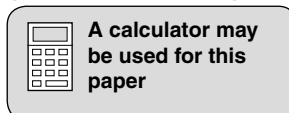
Centre number						Candidate number				
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**INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions **in Section A and Section B**.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Show all your working out for calculations.
- Do **not** write in the bar codes.

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **60**.
- Marks will be awarded for the use of correct conventions.
- Your Quality of Written Communication will be assessed in questions marked with an asterisk (\*).
- Dimensions are in millimetres unless stated otherwise.
- This document consists of **12** pages. Any blank pages are indicated.



SECTION A

Answer **all** questions.

- 1 Fig. 1 shows an incomplete layout of a pneumatic grab game found in amusement arcades. The pneumatic grab is controlled by 3 cylinders **A**, **B**, and **C** which position the grab arm to close around a can of soft drink, allowing it to be picked up.

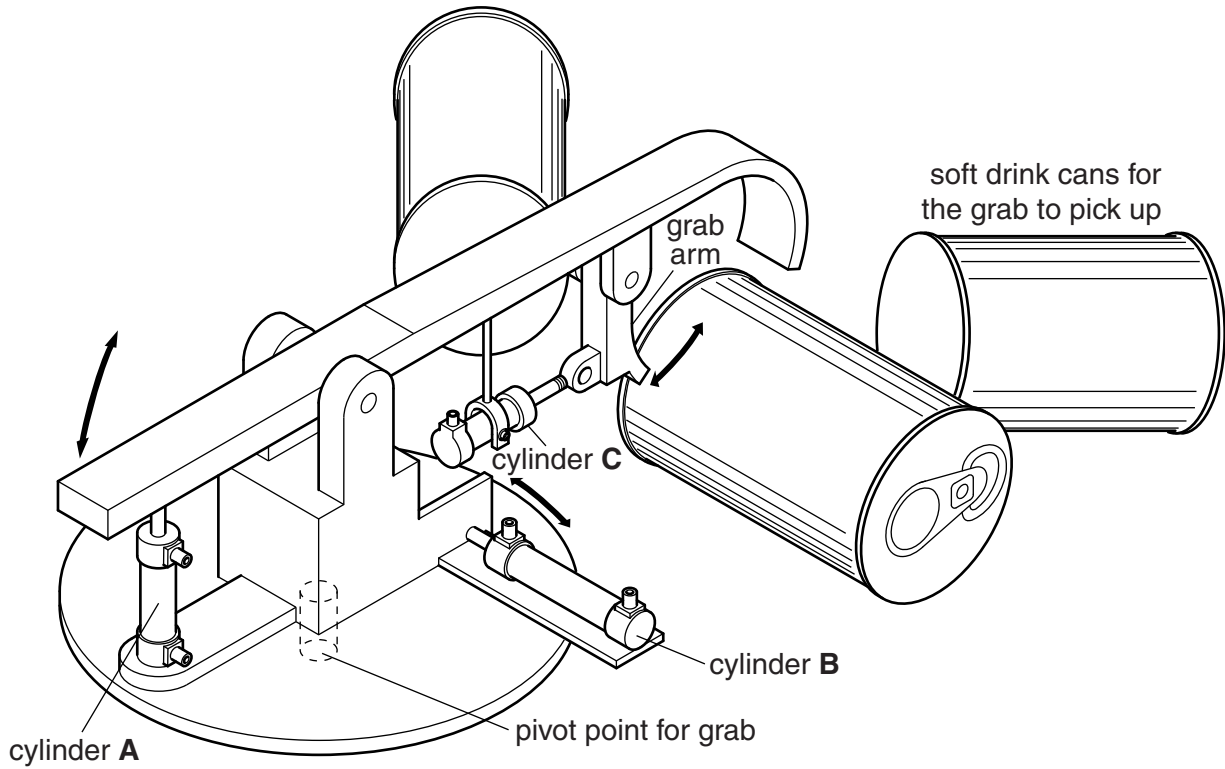


Fig. 1

- (a) Complete the table below by drawing the missing symbols and adding the missing name for three of the components used in the pneumatically controlled grab.

Component Name	Component Symbol
<b>A</b> double-acting cylinder	
<b>B</b> pressure gauge	
<b>C</b> .....	
.....	

[2]

[1]

[2]

(b) Fig. 2 shows two components, **A** and **B**, which could be used to provide a time delay in the grab circuit.

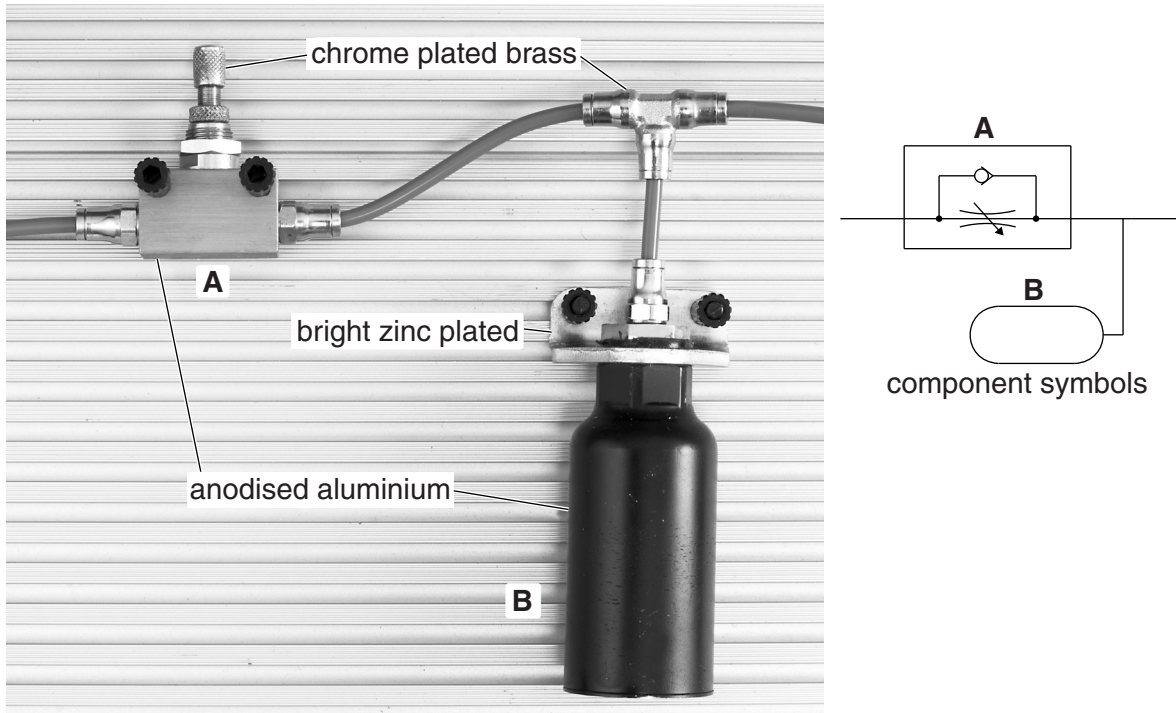


Fig. 2

(i) Give **two** reasons for applying the finishing processes to the components.

- 1 .....
  - 2 .....
- [2]

(ii) The base of component **B** is stamped '**8 BAR MAX**'.  
State the meaning of this information.

..... [1]

(iii) Explain the part played by each of the components in providing a delay.

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..... [4]

[Total: 12]

2 Fig. 3 shows the circuit used to control cylinders **A** and **B** on the grab.

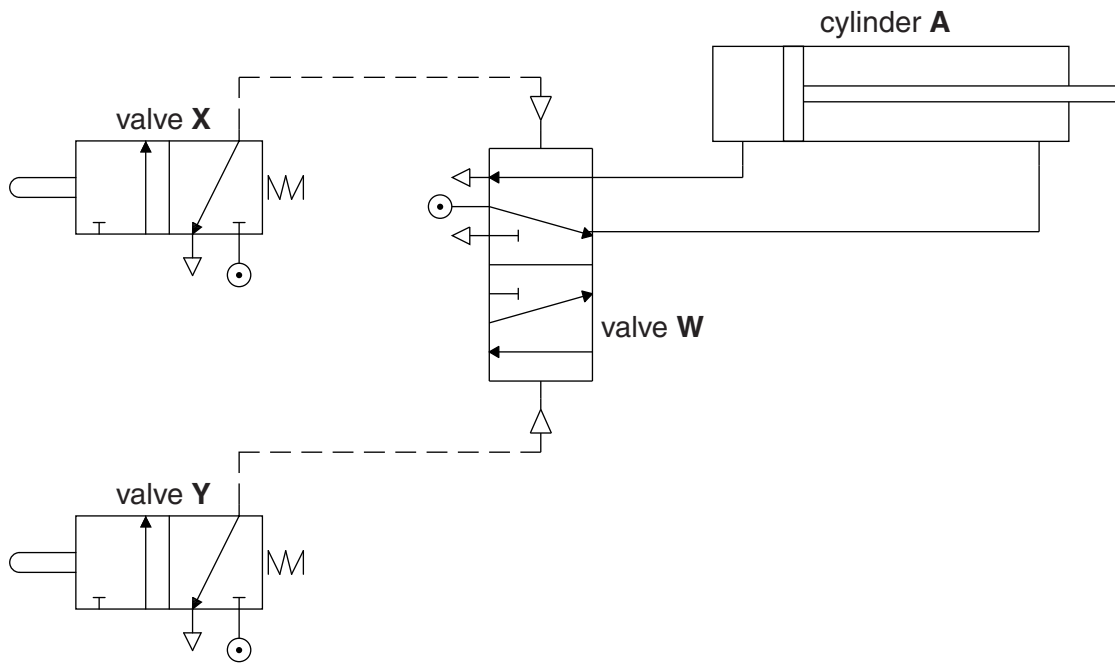


Fig. 3

(a) (i) Using the letters **X**, **Y** and **W** explain how cylinder **A** can be made to raise and lower the grab arm assembly.

.....  
 .....  
 .....  
 .....  
 ..... [4]

(ii) State the reason for the force of the instroke of cylinder **A** being slightly less than the force of the outstroke.

.....  
 ..... [1]

(b) Fig. 4 shows the circuit to control cylinder **C** which is connected to the grab arm.



Fig. 4

Using the letters **Z** and **C** explain how the soft drink can be held by the grab arm using cylinder **C**.

.....

.....

.....

.....

..... [3]

(c) Greater control is required on the closing of the grab arm.  
 Draw a component on Fig. 5 to control the outstroke speed of cylinder **C**, but allow an unrestricted instroke.



Fig. 5

[4]

[Total: 12]

- 3 (a) (i) Cylinders **A** and **B** are changed to double-acting cushioned cylinders to improve the action of the grab.  
Use sketches and notes to describe the difference between cushioned and non-cushioned cylinders.

[2]

- (ii) Give **one** reason why this difference may not show up on a computer simulation of the cylinders operating.

.....  
.....  
..... [1]

- (b) (i) An alternative method of grabbing the can could be to pick it up using a vacuum cup. Describe how this system could pick up a can.

.....  
.....  
..... [2]

- (ii) State the change that will need to be made to the air supply to pick up the can using a vacuum cup.

.....  
..... [1]

(c)\* Compare the use of pneumatic and electronic control systems for machines on production lines.

Marks will be awarded for the quality of written communication in your answer.

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[6]

**[Total: 12]**

SECTION B

Answer **all** questions.

4 Fig. 6 shows the grab arm and cylinder **C** which moves the arm against a drink can.

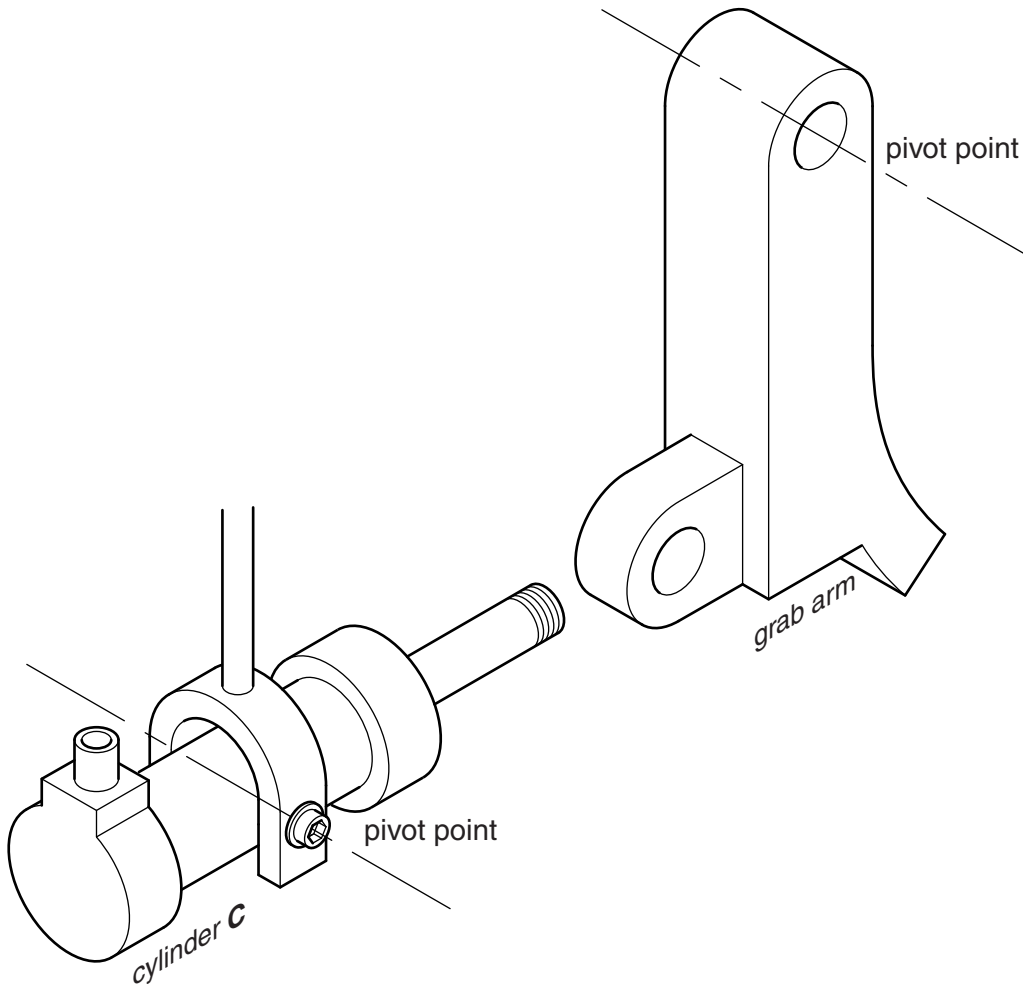


Fig. 6

- (a) (i) Draw a design on Fig. 6 for a connector that will:
- attach to the piston rod
  - attach to the grab arm
  - allow the piston rod to swing the grab arm over a can of drink.

Name all materials used.

[5]

- (ii) Describe a simple quality control check that should be carried out before cylinder **C** is connected to an air supply.

.....

..... [1]





5 To produce compressed air safely a number of components are assembled to form a complete system.

(a) Describe the function of the following components in the production of compressed air:

(i) receiver/reservoir

.....  
.....  
..... [2]

(ii) safety valve

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.....  
..... [2]

(iii) electric motor

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..... [2]

(b) (i) Fig. 7 shows a reed switch cylinder. Explain why this type of cylinder is used in a micro-controlled system.

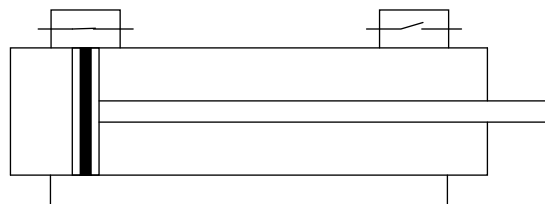


Fig. 7

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..... [2]

- (ii) Quantum Tunnelling Composite (QTC) is a modern material that can be used to sense an applied force in a device such as the grab arm in Fig. 1. Another sensor that could be used is a microswitch. Details of both sensors are shown in Fig. 8.

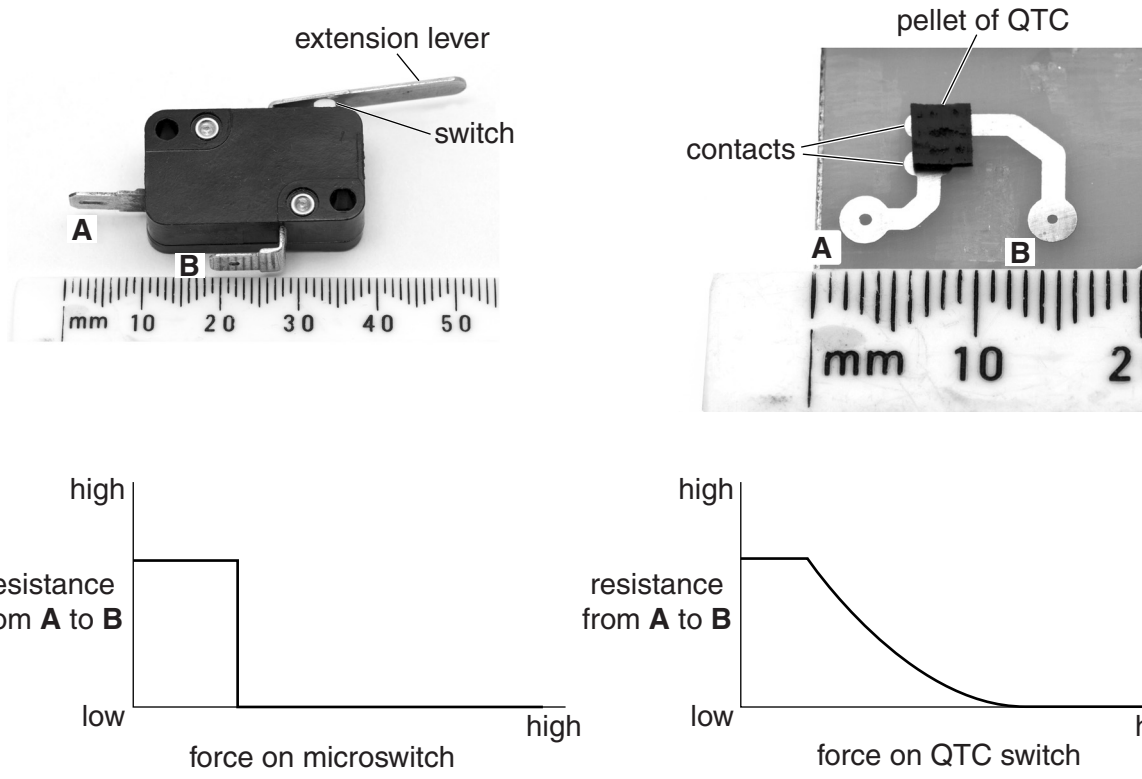


Fig. 8

Give **two** benefits of using QTC as a sensor.

- 1 .....
- 2 ..... [2]

- (iii) Explain how QTC can provide a greater degree of control than a microswitch in a control system.

.....

.....

.....

..... [2]

[Total: 12]

END OF QUESTION PAPER

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