THIS IS A NEW SPECIFICATION

OCR
RECOGNISING ACHIEVEMENT

GENERAL CERTIFICATE OF SECONDARY EDUCATION

DESIGN AND TECHNOLOGY

A514/02

ELECTRONICS AND CONTROL SYSTEMS

Technical aspects of designing and making
Pneumatics

OCE/12024

Candidates answer on the Question Paper

OCR Supplied Materials:
None

Other Materials Required:
- A calculator may be used

Tuesday 22 June 2010
Morning

Duration: 1 hour 15 minutes

A514021

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- 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.

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 is 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.

A calculator may be used for this paper

Section A

Answer **all** questions.

1 Fig. 1 shows a pneumatically controlled tennis ball launcher.

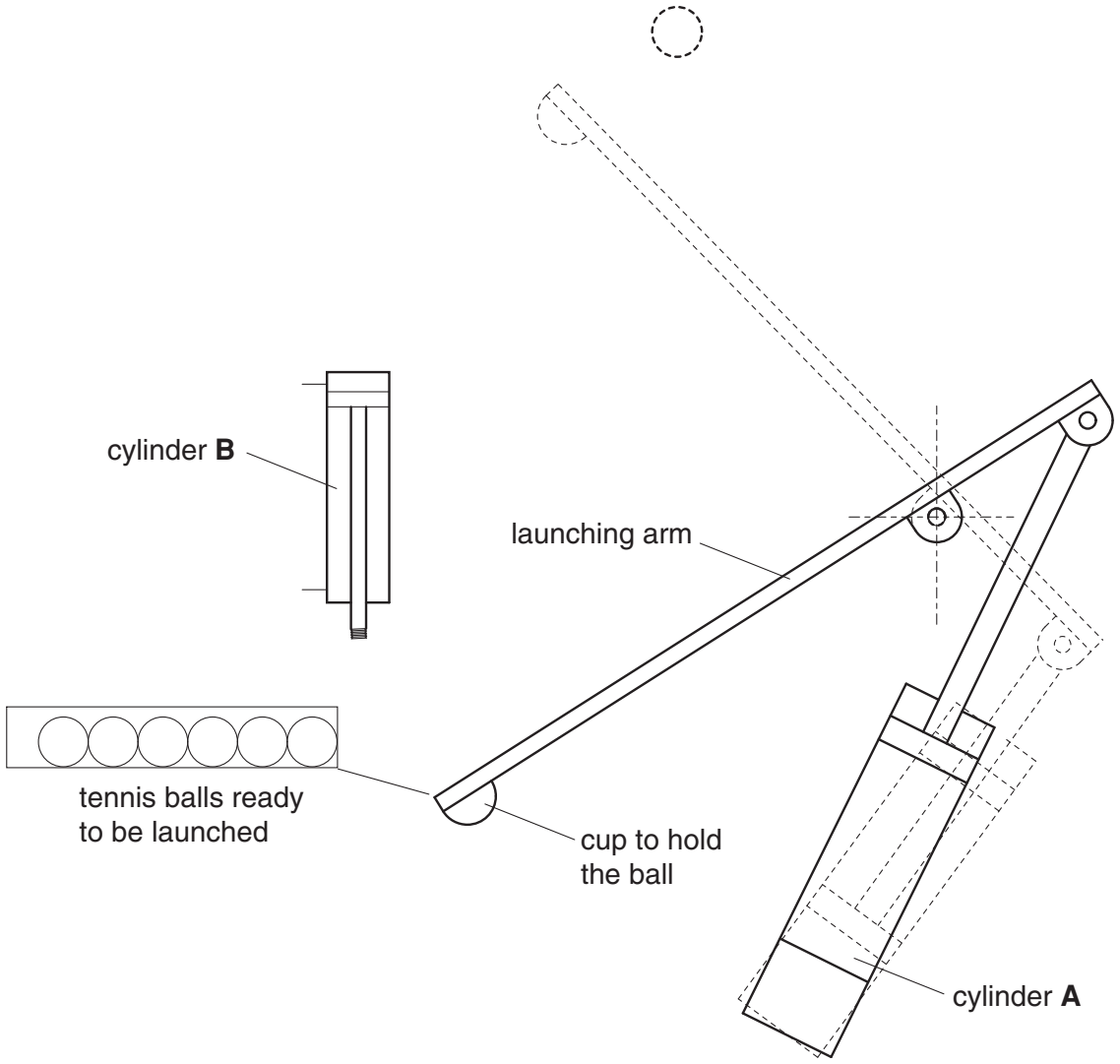
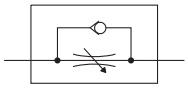
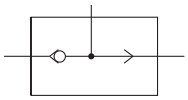


Fig. 1

(a) The table below shows the name and symbol for components in the pneumatically controlled tennis ball launcher.

Complete the table by drawing in the missing symbols and adding the missing names. The first one has been done for you.

component name	component symbol
A air supply	
B ……	
C double acting cylinder	
D …… ……	
E ……	
F push button operated spring return 3/2 valve	

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[2]

[2]

[2]

(b) Explain what the 3/2 refers to in the description of component F in part **1(a)**.

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..... **[3]**

[Total: 12]

2 Fig. 2 shows the components for the circuit that will launch a ball when a button is pressed.

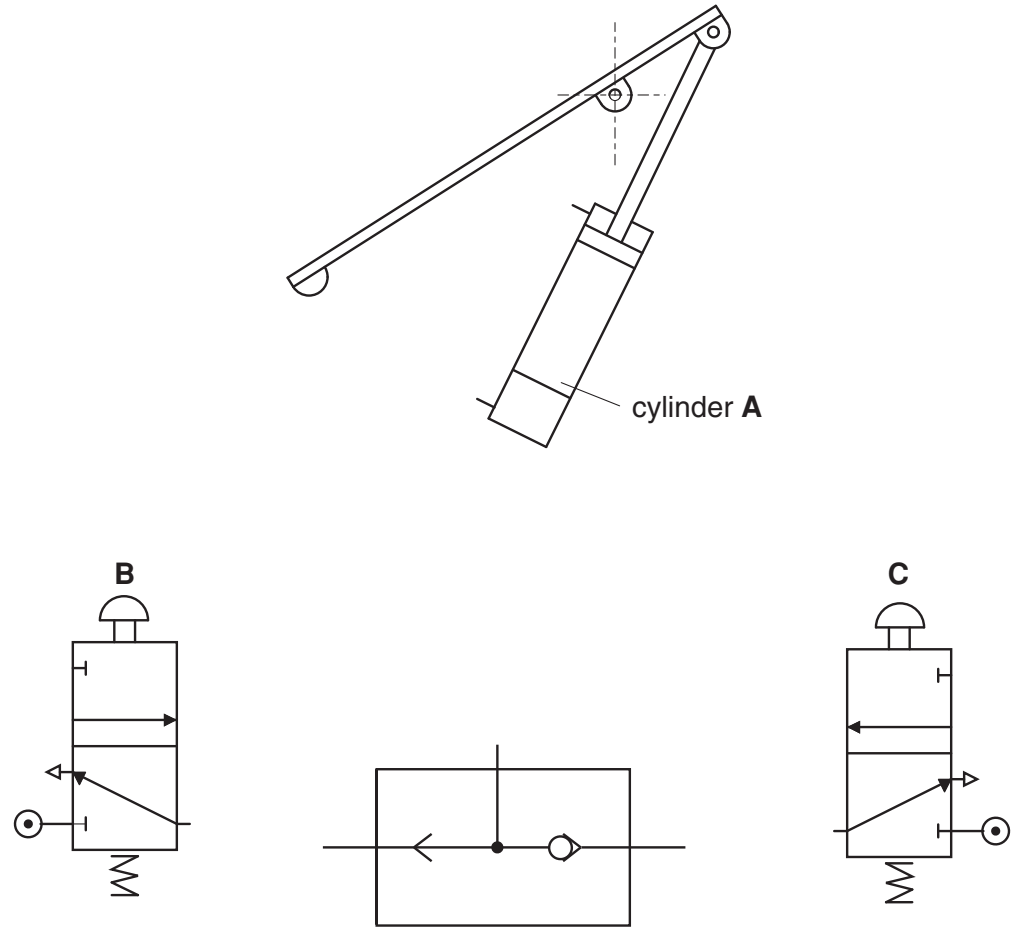

Fig. 2

(a) Complete the circuit in Fig. 2 to launch the ball if either **B** or **C** is pressed. **[3]**

(b) Explain how the completed circuit in Fig. 2 allows either **B** or **C** to launch the ball.

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

(c) The launching movement of the cylinder, or instroking, should be fast so the ball is realistically propelled. The return, or outstroking, of the cylinder to collect another ball should be controlled and slower.

Explain how the component shown in Fig. 3 can be used to control the cylinder as required.

Make reference to the lettered areas.

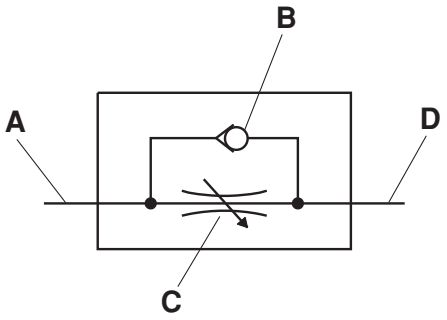

Fig. 3

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3 **(a*)** Discuss the implications of using CAD/CAM for designing and manufacturing pneumatic components.

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(b) It would be possible to control the tennis ball launcher using a computer, microcontroller or a PIC. Some of the components would need to be changed so that they interface with the controller.

One of these components is the valve that the player pushes when a ball is to be launched.

(i) Draw the symbol of the replaced valve which can be interfaced to the controller and will send air to the cylinder when signalled.

[2]

(ii) The launching cylinder would also need to be replaced if the microprocessor is to take control of the launching process.

Fig. 4 shows the replacement cylinder.

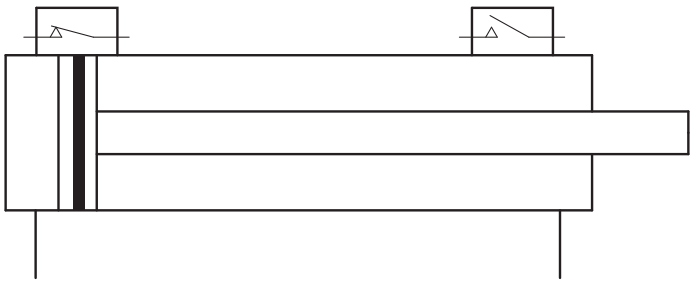

Fig. 4

Explain how this type of cylinder is able to 'tell' the microprocessor where the piston rod is in the launching cycle.

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Section B

4 Fig. 5 shows the incomplete ball release mechanism for the tennis ball launcher.

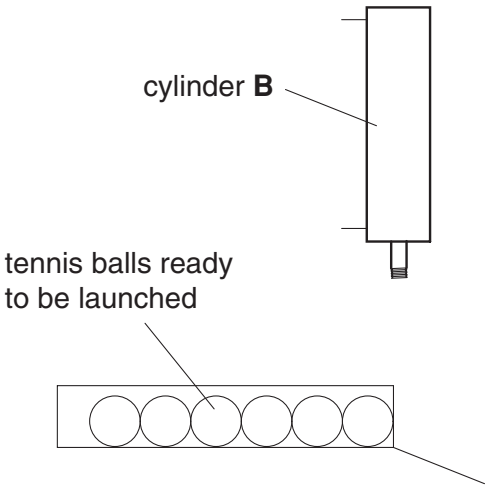

Fig. 5

(a) Draw a design on Fig. 6 below for an attachment that will:

- fit on to the threaded end of the piston rod
- allow a ball to be released when the cylinder instrokes
- include a method of preventing the attachment from becoming loose from the piston rod.

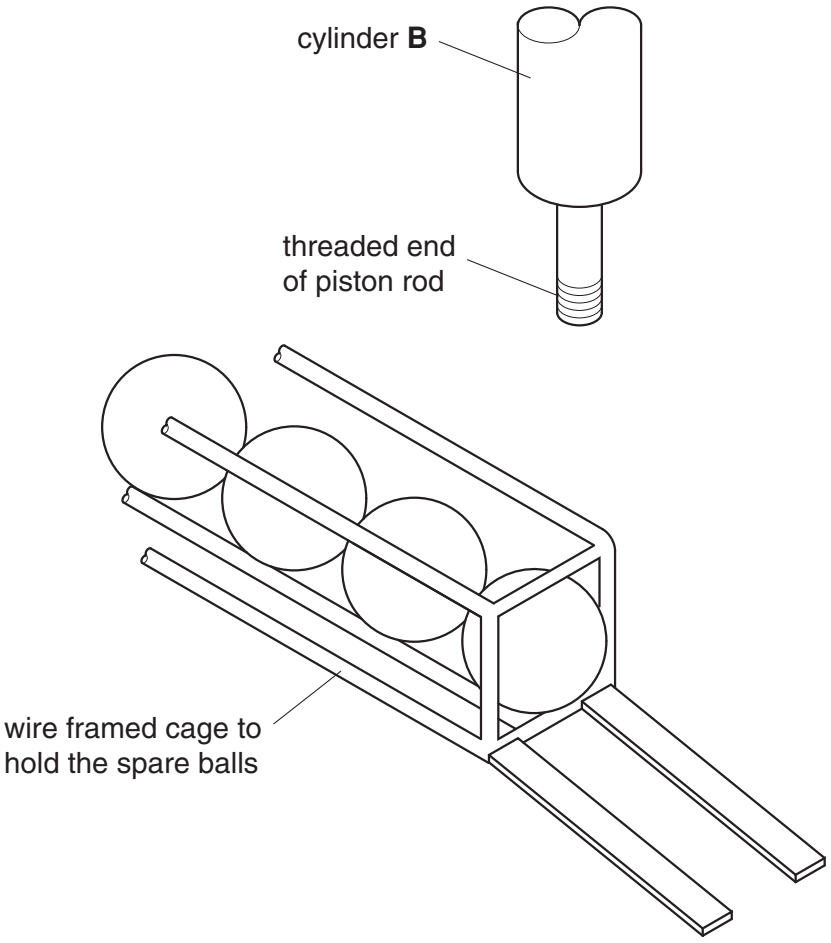

Fig. 6 **[6]**

(b*) Discuss the range of automated applications into which pneumatics can be incorporated.

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5 Cylinder **A** shown in Fig. 7 is connected to the launching arm.

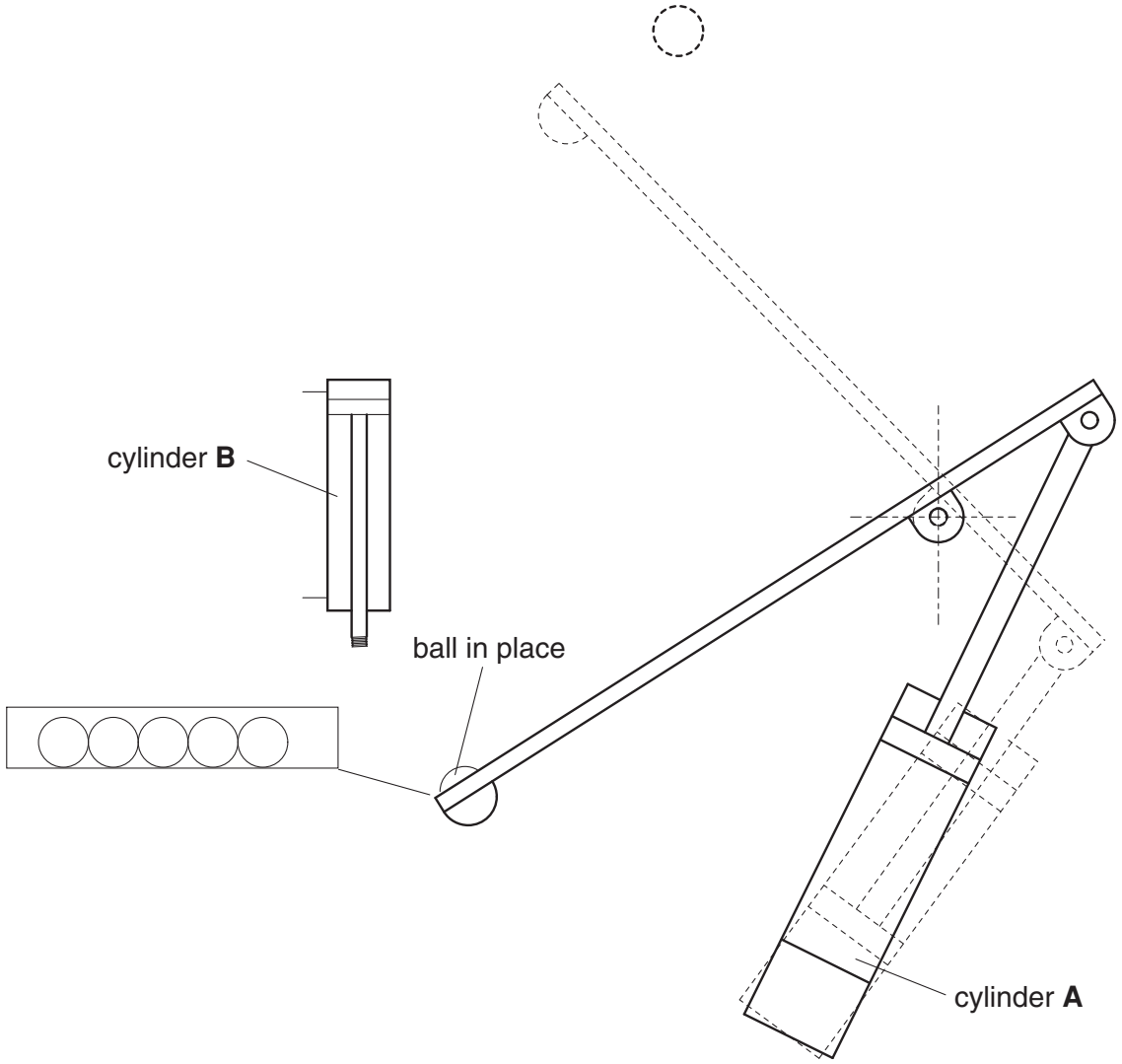

Fig. 7

Measurements show that to get the ball to launch correctly there needs to be a force of 80 N. The air pressure from the compressor is set at 0.15/Nmm^2.

(a) Calculate the minimum diameter of cylinder **A**.
Use the formula Force = pressure × area
Force is in Newtons; pressure is in Newtons per mm^2; area is in mm^2.

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(b) It was found that the launching did not work well because the calculations in part **(a)** were based on the outstroke of the cylinder.

The launching part of the sequence happens on the instroking of cylinder **A**. Explain why there is a difference in force produced between the instroking and outstroking of the cylinder using the same pressure.

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(c) State how the launching can be made more effective without changing any of the components.

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(d) Explain what effect replacing cylinder **A** with a cushioned cylinder would have on the performance of the tennis ball launcher.

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[Total: 12]

PLEASE DO NOT WRITE ON THIS PAGE