

**Tuesday 19 May 2015 – Morning**

## **GCSE DESIGN AND TECHNOLOGY: ELECTRONICS AND CONTROL SYSTEMS**

**A515/02** Sustainability and 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 for this paper.
- Pencil
- Ruler (cm/mm)

**Duration:** 1 hour 30 minutes



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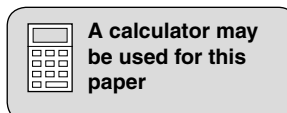
Centre number						Candidate number				
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### **INSTRUCTIONS TO CANDIDATES**

- 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 and make sure that you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined pages at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.
- Show all working out for calculations.

### **INFORMATION FOR CANDIDATES**

- The number of marks for each question is given in brackets [ ] at the end of the question or part question.
- The total number of marks for this paper is **80**.
- Your quality of written communication is assessed in questions marked with an asterisk (\*).
- Dimensions are in millimetres unless stated otherwise.
- This document consists of **20** pages. Any blank pages are indicated.



## SECTION A

Answer **all** the questions.

You are advised to spend 40 minutes on this section.

In questions 1–5 **circle** your answer.

- 1 Using a rechargeable battery can reduce your carbon footprint if you:
- (a) Charge it from a mains socket
  - (b) Recycle it when it's flat
  - (c) Charge it from a solar electric panel
  - (d) Fit it backwards into your product [1]
- 2 Some smart materials:
- (a) Know what you are thinking
  - (b) Respond to tree growth
  - (c) Change their properties when heated
  - (d) Generate carbon credits automatically [1]
- 3 Solar panels harvest energy from:
- (a) Any fossil fuel
  - (b) Sustainable forest timber
  - (c) The movement of the planets
  - (d) The sun [1]
- 4 Coal-fired power stations can contribute to:
- (a) Volcanic ash clouds
  - (b) Acid rain
  - (c) Potholes in roads
  - (d) Improved tree growth [1]
- 5 Reducing the use of chemicals dangerous to the environment can:
- (a) Increase charity shop profits
  - (b) Save you money
  - (c) Help keep your garden fence green
  - (d) Contribute to preserving the world's eco-systems [1]

6 Complete the following to give the meaning of the abbreviation RoHS.

Restriction of H..... S..... [1]

7 State **one** source of renewable energy.

..... [1]

8 Give **one** reason why excessive carbon dioxide emissions may be harmful to the environment.

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

9 State the meaning of the term 'biodegradable'.

..... [1]

10 Which of the 6Rs describes the disassembly and reprocessing of materials for use in new products?

..... [1]

Decide whether the statements below are **True** or **False**.

Tick (✓) the box to show your answer.

	<b>True</b>	<b>False</b>	
11 Globalised companies only sell their products in the United Kingdom	<input type="checkbox"/>	<input type="checkbox"/>	[1]
12 All redundant products should be sent to landfill	<input type="checkbox"/>	<input type="checkbox"/>	[1]
13 All designers of mobile phones include built-in obsolescence	<input type="checkbox"/>	<input type="checkbox"/>	[1]
14 Leaving televisions on standby wastes energy	<input type="checkbox"/>	<input type="checkbox"/>	[1]
15 WEEE regulations help with safe disposal of faulty electronic products	<input type="checkbox"/>	<input type="checkbox"/>	[1]

16 Fig. 1 shows a wind-up rechargeable radio.



Fig. 1

(a) Identify **three** design features of the wind-up radio shown in Fig. 1.

- 1 .....
- 2 .....
- 3 .....

[3]

(b) The wind-up radio includes a small rechargeable battery.

Give **one** benefit of including a rechargeable battery in the wind-up radio.

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

(c) The wind-up radio can be dismantled into its component parts using only a small cross-point screwdriver.

Give **two** benefits of this to the environment.

- 1 .....
- .....
- 2 .....
- .....

[2]

(d) The wind-up radio contains components made of different materials.

Choose from the following recycling processes to complete the table below, matching a recycling process to each material.

- Tertiary recycled
- Removed, tested and re-used
- Melted down and refined
- Sorted then melted down and re-used
- Ground up and used as filler

Material	Recycling process
Metal	<i>Melted down and refined</i>
Different thermoplastics	
Thermosetting plastics	
Electronic components	

[3]

(e) Give **two** ways that the wind-up radio could be disposed of by primary recycling.

1 .....

.....

2 .....

.....

[2]

**6**

**(f)** Use sketches and notes to illustrate to the user how to operate the wind-up radio.

**[3]**



## SECTION B

Answer **all** the questions.

You are advised to spend 50 minutes on this section.

- 17 Fig. 2 shows an incomplete design for a pneumatically controlled model rocket launcher. When cylinder **A** is instroked the launch arm will move through an arc and the model rocket will be released. Cylinder **A** can then be outstroked again to be ready for the next launch.

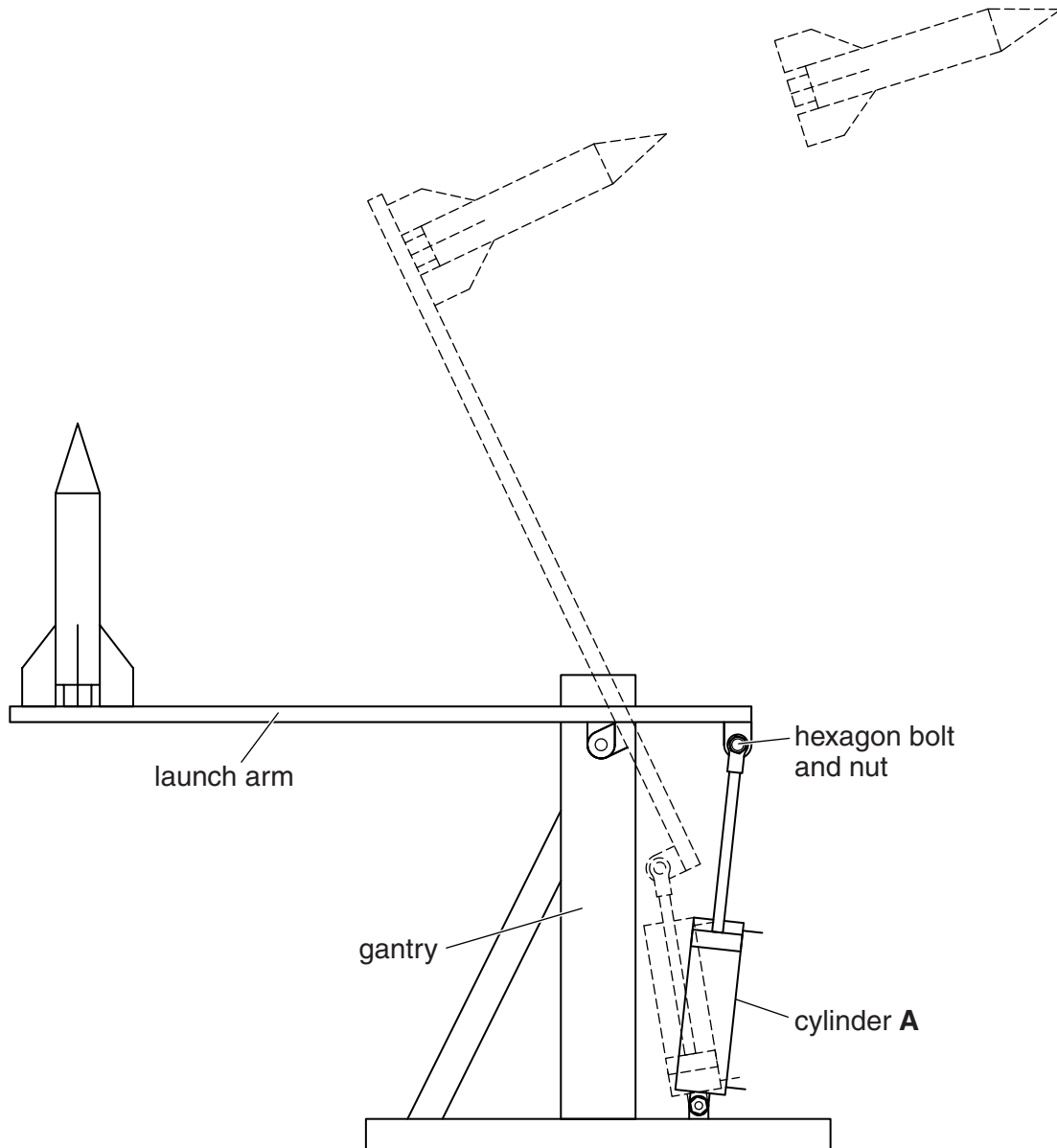
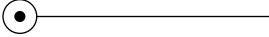
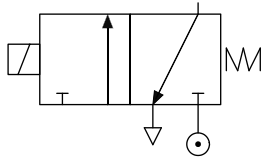


Fig. 2



- (a) The table below shows the name and symbol for some of the components available for use in the model rocket launcher.

Complete the table by drawing in the missing symbol and adding the missing names.

Component name	Component symbol	
<b>A</b> ..... .....		[1]
<b>B</b> roller plunger		[1]
<b>C</b> ..... .....		[2]

- (b) In the production of compressed air a large receiver tank is normally located near to the compressor.

(i) Give **two** reasons for using a large receiver tank.

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

(ii) Explain why there is normally a tap at the lowest point of the receiver tank.

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

(iii) Receiver tanks are often made from mild steel.

Give **one** benefit and **one** drawback of using mild steel for a receiver tank.

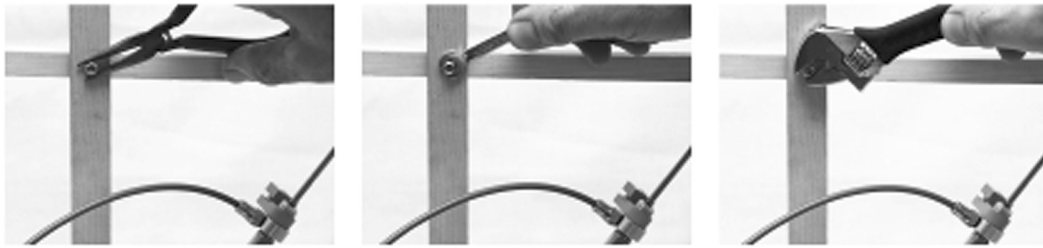
- Benefit .....  
 Drawback .....

[2]

Turn over

- (c) Pneumatic cylinders and valves are often secured to a framework with hexagon nuts and bolts as shown in Fig. 2.

Fig. 3 shows three tools that could be used for tightening or loosening a hexagon nut.



A

B

C

Fig. 3

- (i) Give **one** reason why tool **A** should not be used.

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

- (ii) A designer may specify the maximum torque that should be applied to a nut.

Explain what is meant by maximum torque.

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

(d) Fig. 4 shows an initial model of the model rocket launcher used to test the power of the cylinder.

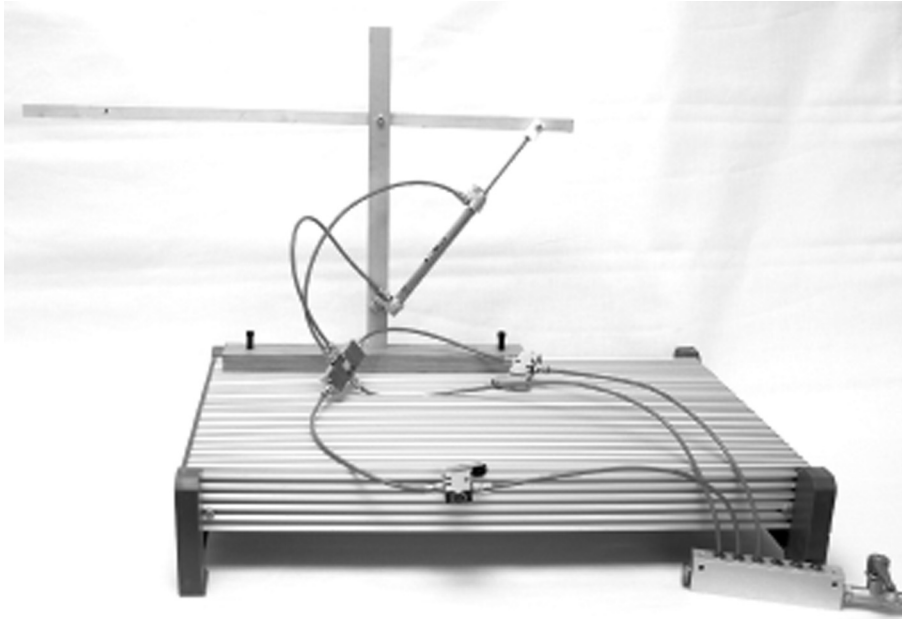


Fig. 4

Describe what should be done before the circuit is connected to an air supply.

.....

.....

..... [2]

18 (a) An incomplete circuit for the launch arm is shown in Fig. 5.

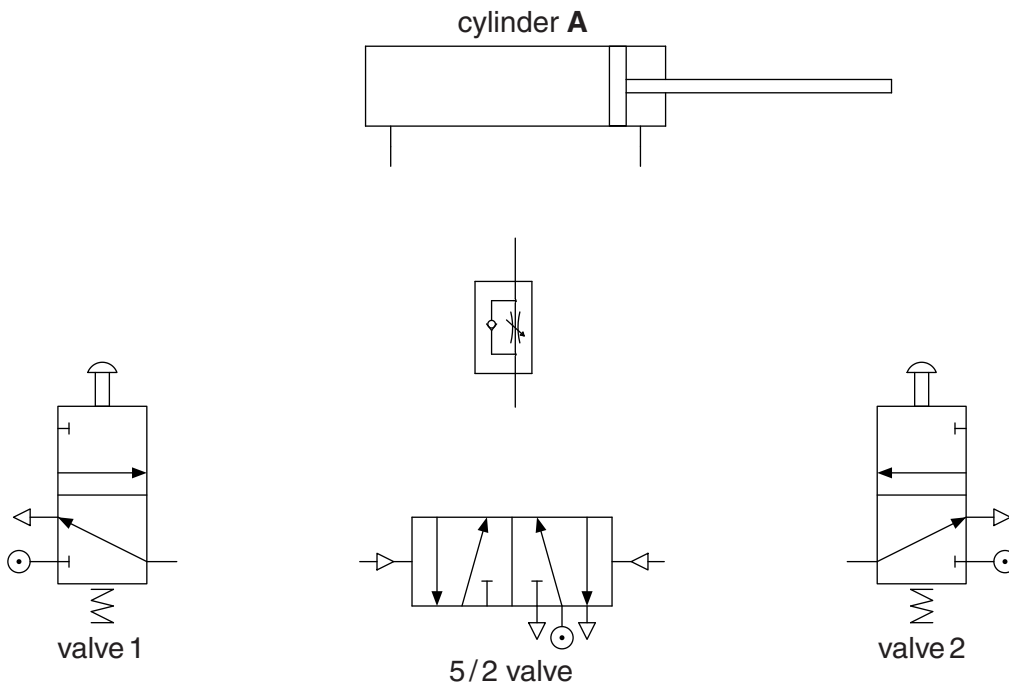


Fig. 5

(i) Complete Fig. 5 to show the connections between the valves to allow the model rocket to be launched and the launch arm to then be returned slowly to the start position, with the piston outstroked. [3]

(ii) State which valve has been pressed and released to outstroke cylinder A.

..... [1]

(b) The initial design in Fig. 2 shows the launch taking place when cylinder A is instroked. Draw on Fig. 6 to show how the outstroke of the cylinder could be used for the launch.

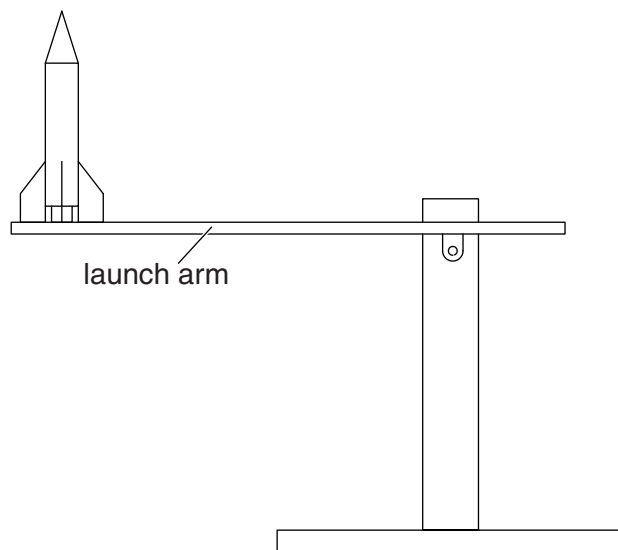


Fig. 6

[2]

(c) State why cylinder **A** should not be a cushioned cylinder.

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

(d) Fig. 7 shows an arrangement of valves for the launch control that will make the circuit safer to operate. The two valves are placed three metres apart.

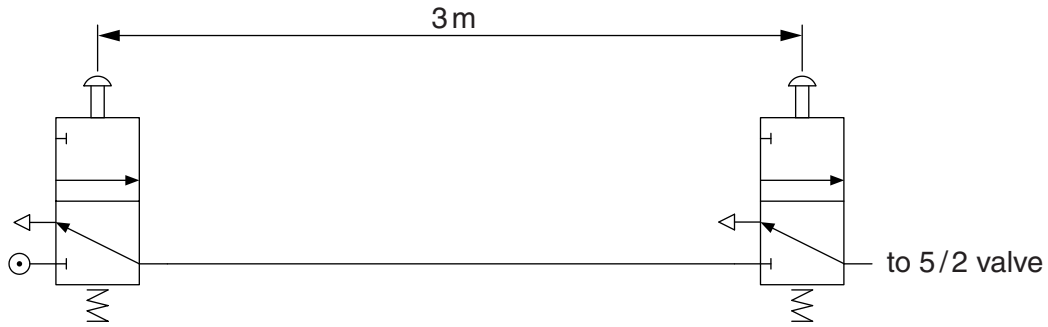


Fig. 7

(i) State why the circuit will now need two people to carry out the launch.

..... [1]

(ii) Name the logic function in this improved arrangement.

..... [1]





(c) After cylinder **B** has started to outstroke, the next part in the sequence should begin just before the piston has stopped moving at the end of its travel, at point **X** in Fig. 8.

Use sketches and notes to show how:

- a signal can be produced when the piston from cylinder **B** reaches point **X**
- the signal can be used to instroke cylinder **A**.

[6]

(d) The model rocket launcher is a prototype.

Give **two** reasons for prototyping a design before final production.

1 .....

.....

2 .....

.....

[2]

**END OF QUESTION PAPER**



**ADDITIONAL ANSWER SPACE**

If additional answer space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margins.

A large area of lined paper for writing answers. It features a vertical margin line on the left side and horizontal dotted lines for writing. The lines are evenly spaced and extend across the width of the page.





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