OCR
RECOGNISING ACHIEVEMENT

SPECIMEN

GENERAL CERTIFICATE OF SECONDARY EDUCATION

DESIGN AND TECHNOLOGY: ELECTRONICS AND CONTROL SYSTEMS **J301**

A515/02 Sustainability and technical aspects of designing and making - Pneumatics

Candidates answer on the question paper
A calculator may be used for this paper

OCR Supplied Materials:
None

Other Materials Required:
- Pencil
- Ruler (cm/mm)

Duration: 1 hour 30 minutes

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 in Section A **and** Section B.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.
- Do not write in Bar Codes.
- Show all working out for calculations.

INFORMATION FOR CANDIDATES

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

For Examiner's Use		
	Max	**Mark**
1	**1**	
2	**1**	
3	**1**	
4	**1**	
5	**1**	
6	**1**	
7	**1**	
8	**1**	
9	**1**	
10	**1**	
11	**1**	
12	**1**	
13	**1**	
14	**1**	
15	**1**	
16	**20**	
17	**15**	
18	**15**	
19	**15**	
TOTAL	**80**	

Section A

Answer **all** questions

On questions 1 – 5 circle your answer

1 If a product is said to have a large carbon footprint, does it:

(a) Leave large black marks on a carpet

(b) Need special care when transporting it

(c) Produce a significant amount of carbon dioxide during its manufacture or use

(d) Only fit into large recycling bins **[1]**

2 What information does this symbol tell the consumer about the product?

(a) Product won't tip over

(b) It is made of polystyrene

(c) It is repairable

(d) It is person safe **[1]**

3 Solar power devices are fitted to houses to:

(a) Save water

(b) Stop draughts

(c) Make houseplants grow

(d) Reduce energy costs **[1]**

4 A biomass boiler burns which of the following to produce energy:

(a) Plant and wood-derived pellets or shavings

(b) Coal

(c) Crude Oil

(d) Natural Gas **[1]**

5 When a re-chargeable battery is discharged, you should:

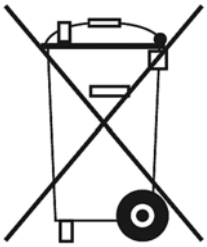
(a) Return it

(b) Reverse it

(c) Complain to the manufacturer

(d) Recharge it **[1]**

6 State what is meant by the symbol shown below:



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

7 State the name of one green source of energy.

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

8 State why the use of recycled paper is a good idea.

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

9 State why plumbers are required to use lead-free solder for connecting domestic water pipes.

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

10 State the term that describes the design of an electronic product to ensure the comfort of its user.

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

Decide whether each of the following statements is true or false.

Tick (✓) the box to show your answer.

		True	False	
11	An energy saving light bulb is easier to switch on than a filament bulb	☐	☐	**[1]**
12	A “sweatshop” is somewhere with poor working conditions	☐	☐	**[1]**
13	Recycling is an initiative to promote bicycle sharing	☐	☐	**[1]**
14	Car sharing decreases overall carbon emissions	☐	☐	**[1]**
15	The Forest Stewardship Council encourages using sustainable forest products	☐	☐	**[1]**

16 Fig. 1 shows an assembled solar powered lamp.

Fig. 1

(a) The solar powered lamp is packaged in a box made of recycled cardboard.

(i) State why this is considered good environmental practice.

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

(ii) The manufacturer has printed assembly instructions showing how to assemble the lamp on the outside of the box.

State which of the 6Rs this illustrates.

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

(iii) State **one** benefit of printing the assembly instructions on the outside of the box.

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

(b) The solar powered lamp contains a Ni-Cad cell.

(i) State how a worn out Ni-Cad cell should be disposed of.

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

(ii) If the worn out cell was replaced, state which of the 6Rs would have been fulfilled.

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

(iii) Since 2008 an EU directive has banned all manufacturers/distributors from importing Ni-Cad batteries into Europe.

Give **one** reason why this legislation has been introduced.

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

(c) The WEEE Directive aims to both reduce the amount of electrical and electronic equipment being produced and to encourage everyone to reuse, recycle and repair it.

Look at Fig. 2a and 2b and explain how the designer has made the solar powered lamp WEEE compliant.

Fig. 2a

Fig. 2b

.....

.....

.....

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

(d) **(i)** Fig. 3 shows a solar torch built using the components from a solar powered lamp.

Fig. 3

State which of the 6Rs the designer of this product has applied.

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

(ii) Although fully functional, the solar torch in Fig. 3 lacks user appeal.

Use sketches and notes to show an improved version of the torch below.

[4]

(e)* Fig. 4 shows a wind farm that contains over a hundred wind turbines.

Fig. 4

Discuss the impact a large on-shore or off-shore wind farm could have on our needs for power and how it might affect the environment.

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

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.... **[6]**

Section B

Answer **all** questions

17 Fig. 5 shows a press used to insert skateboard bearings into the wheels.

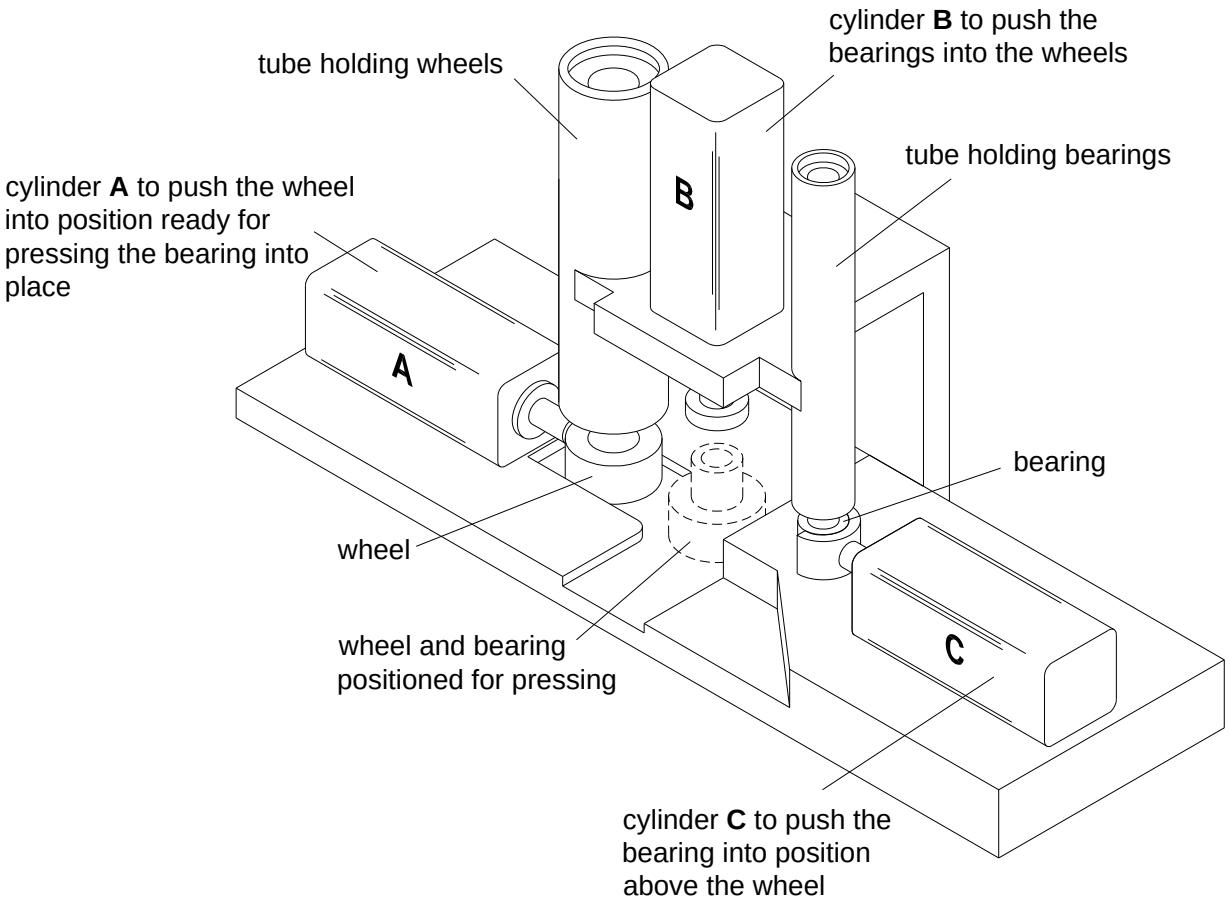
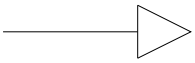
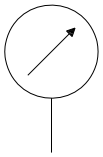
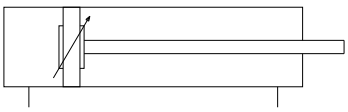
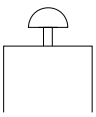


Fig. 5

(a) The table below shows the name and symbol for some of the components in the pneumatically controlled press shown in Fig. 5.

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

The first one has been done for you.

Component name	Component symbol	
A exhaust		
B		**[1]**
C bi-directional restrictor		**[2]**
D		**[2]**
E		**[2]**
F foot pedal operated spring return 3/2 valve		**[2]**

(b) Explain how the flow of air through a bi-directional restrictor can be adjusted.

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.....

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

(c) **(i)** State the purpose of a regulator in a pneumatic system.

.....

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

(ii) Use sketches and notes to show where a drain valve would be located in a pneumatic system.

[2]

18 Fig. 6 shows the system for pressing the bearings into the wheels.

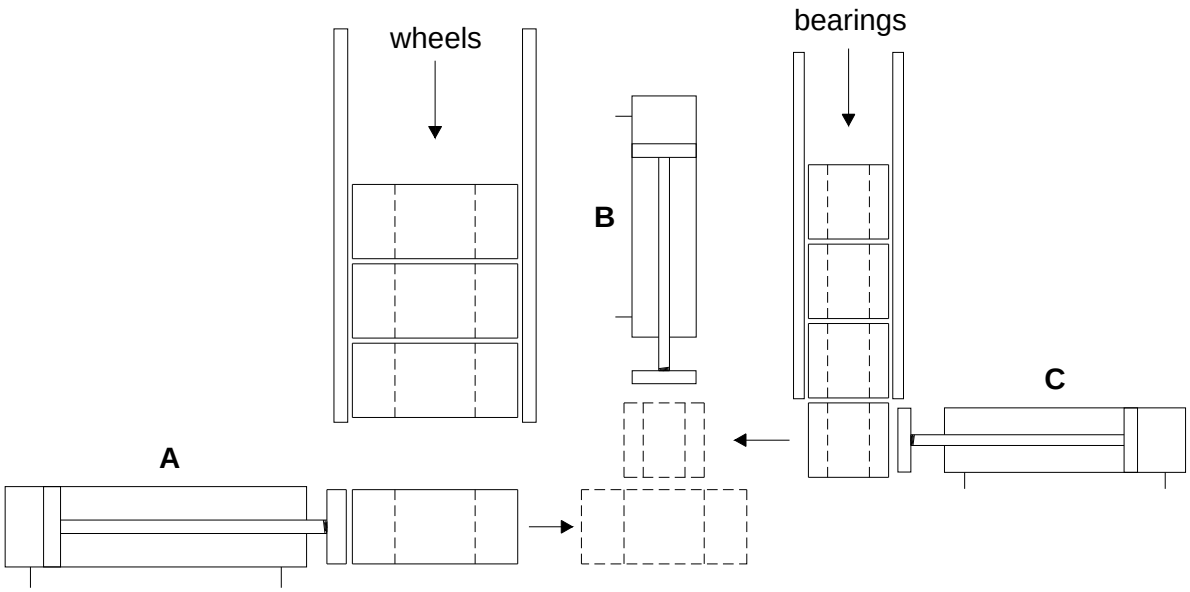

Fig. 6

When the system was first tested it was found that the wheel following the one pushed into place fell on to the outstroked piston rod as shown in Fig. 7. This caused the process to stop working.

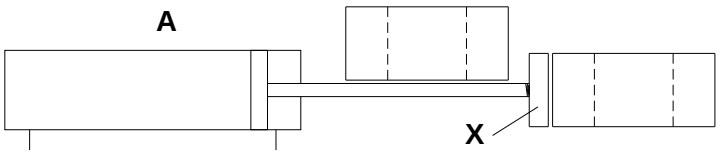

Fig. 7

(a) Draw a design on Fig. 8 for an attachment that will:

- fit on to the plate labelled **X** on the end of the piston rod
- prevent the following wheel dropping on the piston rod
- include a method of fixing the attachment to component **X**.

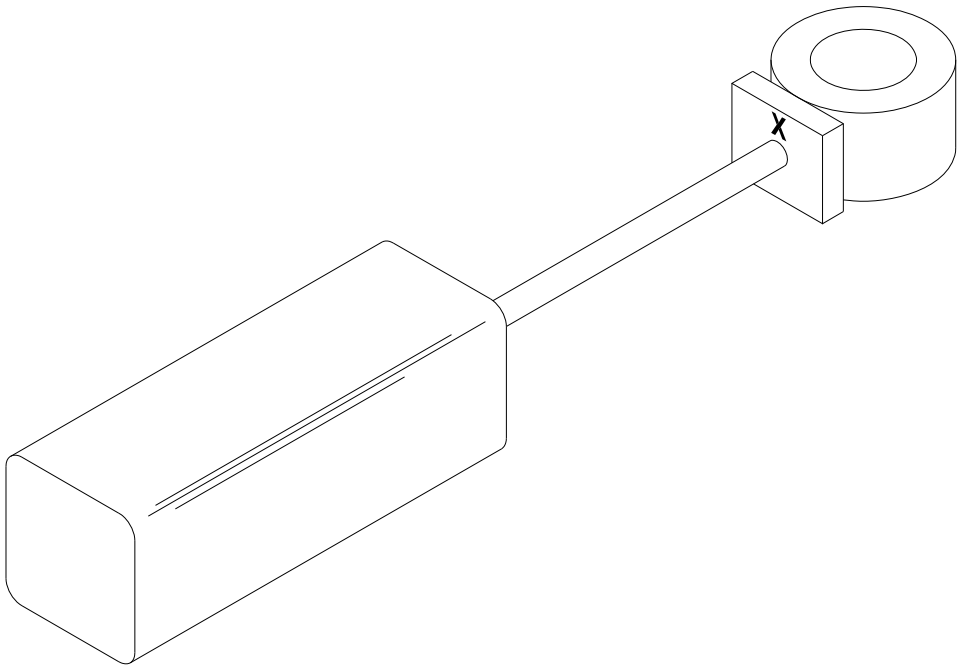

Fig. 8

[6]

(b) Fig. 9 shows two types of screw that could be used to fasten the cylinder in place.

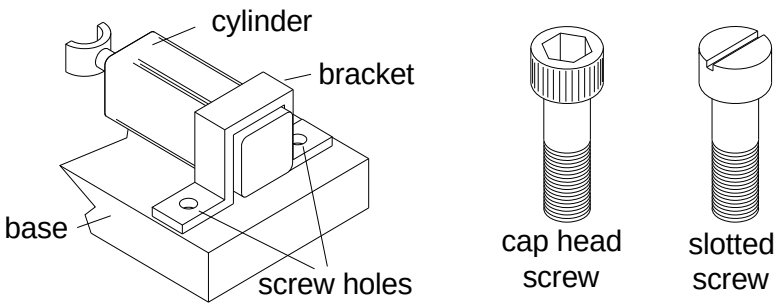

Fig. 9

(i) Explain why the cap head screw is the best choice.

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

(ii) Give **one** method of preventing the screw from coming loose when the cylinder is in use.

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

(c)* Discuss the implications of automating processes that were previously carried out manually.

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

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....**[6]**

19 Cylinder **B** shown in Fig. 10 provides the force to push the bearing into the wheel.

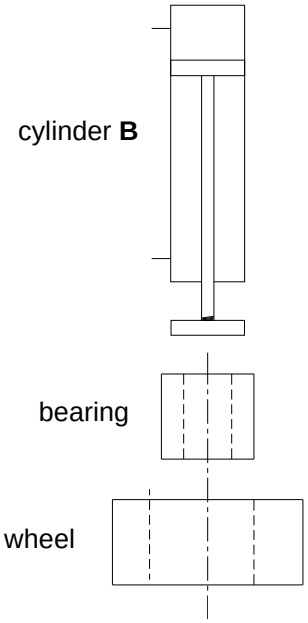

Fig. 10

(a) The force required to push the bearing into the wheel was found to be 100N.

The available cylinder was 30mm diameter.

Calculate the minimum air pressure required to push the bearing fully into the wheel.

Use the formula F = P x A.

.....

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

(b) To protect the operator of the system a logic arrangement could be used to ensure that the operator's hands cannot be trapped by moving parts.

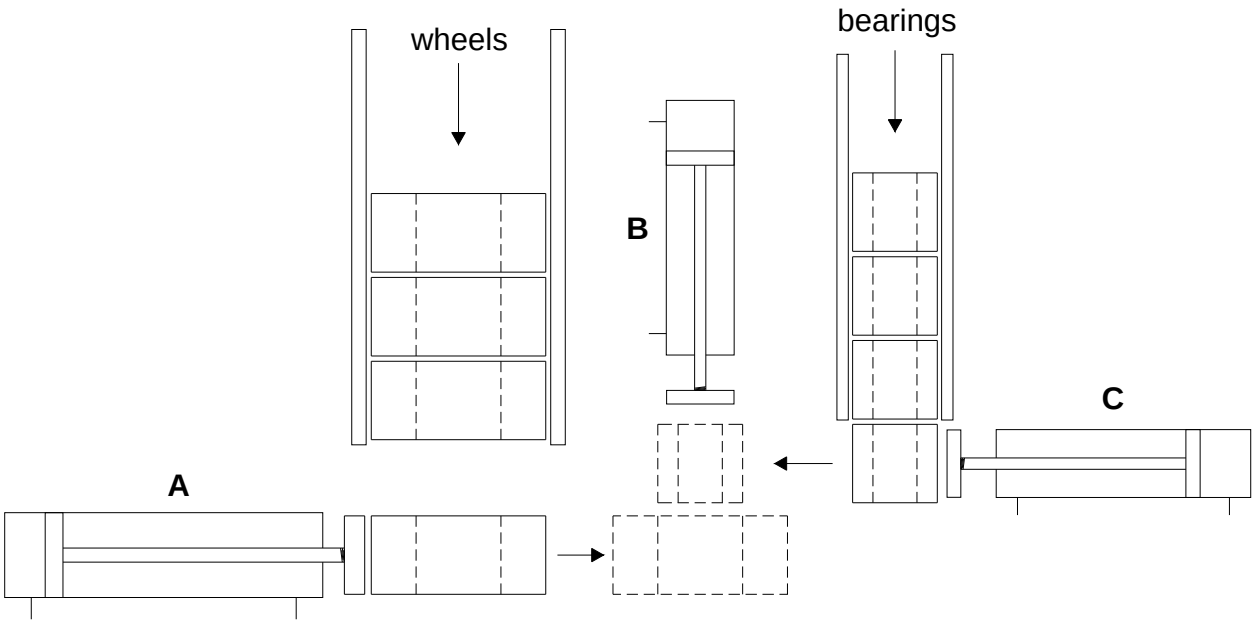
(i) State the name of the logic that is used.

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

(ii) Using standard pneumatic components show how the logic arrangement can be assembled.

[2]

(c) Cylinders **A**, **B** and **C** must operate in the correct sequence to press the bearings into the wheels.



The system is shown in Fig. 11.

Fig. 11

Using '**+**' for outstroking and '**-**' for instroking state the order of operation of cylinders **A**, **B** and **C**.

The sequence starts and ends as shown in Fig. 11.

Cylinders **A** and **C** remain outstroked until the bearing is in place.

The first movement of cylinder A is completed.

A+ ..... **[5]**

(d) To make the process fully controllable uni-directional restrictors are placed in the circuit of each cylinder.

Explain why using a uni-directional restrictor will make the process faster than using a bi-directional restrictor.

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

END OF QUESTION PAPER

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PLEASE DO NOT WRITE ON THIS PAGE

OCR
RECOGNISING ACHIEVEMENT

SPECIMEN

Sample Assessment Material

DESIGN AND TECHNOLOGY: ELECTRONICS AND CONTROL SYSTEMS

A515/02 Sustainability and technical aspects of designing and making - Pneumatics

MARK SCHEME

Duration: 1 hour 30 minutes

MAXIMUM MARK 80

DRAFT

MARKING INSTRUCTIONS

PREPARATION FOR MARKING
SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to scoris and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

TRADITIONAL

Before the Standardisation meeting you must mark at least 10 scripts from several centres. For this preliminary marking you should use **pencil** and follow the **mark scheme**. Bring these **marked scripts** to the meeting.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the scoris messaging system, or by email.

5. Work crossed out:
   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
   b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. There is a NR (No Response) option. Award NR (No Response)
   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in anyway relate to the question (e.g. 'can't do', 'don't know')
   - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question

   Note: Award 0 marks - for an attempt that earns no credit (including copying out the question)

8. The scoris **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
   If you have any questions or comments for your team leader, use the phone, the scoris messaging system, or e-mail.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:
    a. **To determine the level** – start at the highest level and work down until you reach the level that matches the answer
    b. **To determine the mark within the level**, consider the following:

Descriptor	***Award mark***
On the borderline of this level and the one below	*At bottom of level*
Just enough achievement on balance for this level	*Above bottom and either below middle or at middle of level (depending on number of marks available)*
Meets the criteria but with some slight inconsistency	*Above middle and either below top of level or at middle of level (depending on number of marks available)*
Consistently meets the criteria for this level	*At top of level*

Section A

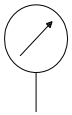
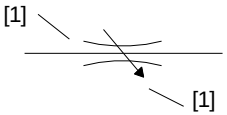
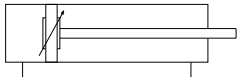
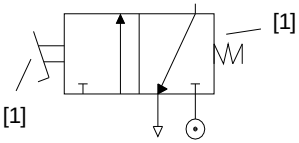
Question			Answer	Marks	Guidance
1			(c) Produce a significant amount of carbon dioxide during its manufacture or use	1	
2			(b) It is made of polystyrene	1	
3			(d) Reduce energy costs	1	
4			(a) Plant and wood-derived pellets or shavings	1	
5			(d) Recharge it	1	
6			Item should not be placed in (domestic waste) bin, not intended for landfill.	1	Reason stated. Not 'recycle'.
7			Wind, wave, hydro-electric, solar (voltaic or heat), geothermal, tidal.	1	Not water alone.
8			Means that trees are not used to produce new product.	1	
9			Lead is poisonous / harmful to humans / a cumulative poison /hazardous.	1	Do not accept 'dangerous'.
10			Ergonomics or anthropometrics.	1	No variations.
11			False	1	
12			True	1	
13			False	1	
14			True	1	
15			True	1	
			Total	15	

Question			Answer	Marks	Guidance
16	(a)	(i)	Does not use any trees or new material or saves energy in making, no need to make new cardboard.	1	Not 'can be recycled'.
		(ii)	Reduce or Rethink.	1	
		(iii)	Any two of: uses less materials/paper in making product, potential purchaser can see if it is within their capabilities, less space needed in box, so transport costs are reduced, will user be able to assemble, less likely to lose instructions.	1	
	(b)	(i)	Taken to a battery bank / "batteryback" container / battery container / back to shop where bought / council waste facility for 'recycling'.	1	Not 'recycling' alone.
		(ii)	Repair, do not allow reuse.	1	
		(iii)	To help stop cadmium from non-recycled cells entering landfill sites, cadmium is poison/harmful to life.	1	Needs to focus on poison, toxic to environment/human.
	(c)		Max three marks for an accurate explanation: Points relating to how the object can be reduced to its component parts (1) quickly and easily without recourse to tools (1) so that they can be re-used or recycled (1) especially removal of circuitry and/or cell (1) and separation of plastic parts from each other/circuitry (1). No tools required in this case to repair circuit or replace cell (1).	3	Repair, reuse and recycle ONLY if justified or explained.
	(d)	(i)	Reuse, do not allow repair.	1	
		(ii)	Sketches and notes, ergonomic shape and/or grip/switch placement/type or modification e.g. slide switch, slimmer / longer / rounder shape to suit the human hand, carrying strap, more aesthetically pleasing . Features or features and justification, internal circuitry or additional functions. 4x1 or 2x2.	4	Must IMPROVE aspects of the existing boxy design / red / white only. Watch for duplicate sketch and description.

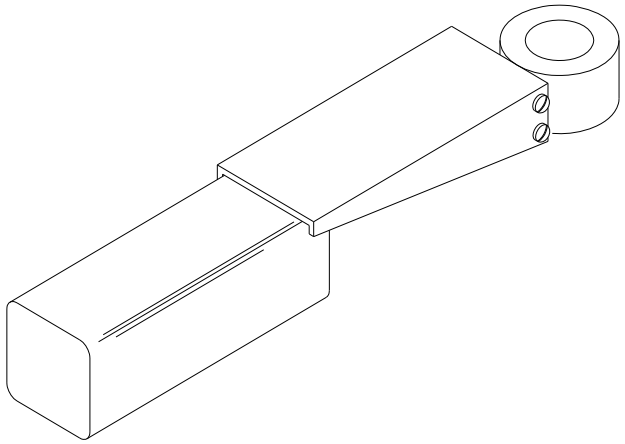
Question			Answer	Marks	Guidance	
					Content	**Levels of response**
	(e)*		Answers should have information showing some relevant knowledge of likely impact wind farms could have on the UK: • realistic figures for % contribution (1-20%), • possible locations, not just 'hilly' or 'windy' places" • impact on environment should mention visual, wildlife hazard, migrating birds, noise of blades, visual disturbance strobe effect, loss of visual amenity for residents • NIMBYism / NOMFDS, • benefits of offshore/onshore, • large amounts of concrete needed, • capital cost, • offset consumption of fossil fuel, • less CO2 emission.	**6**	Relevant points need justification.	**Level 3 (5-6 marks)** Thorough discussion, showing a clear understanding of the likely impact wind farms could have on the UK. There will be three or more clearly identified and explained points. Specialist terms will be used appropriately and correctly. The information will be presented in a structured format. The candidate will demonstrate the accurate use of spelling, punctuation and grammar. **Level 2 (3-4 marks)** Adequate discussion, showing an understanding of the likely impact wind farms could have on the UK. There will be some use of specialist terms, although these may not always be used appropriately. The information will be presented for the most part in a structured format. There may be occasional errors in spelling, grammar and punctuation. **Level 1 (1-2 marks)** Basic discussion, showing some understanding of the likely impact wind farms could have on the UK. There will be little or no use of specialist terms. Answers may be ambiguous or disorganised or 'list like'. Errors of grammar, punctuation and spelling may be intrusive. 0 marks = no response or no response worthy of credit
			Total	**20**		

Section B

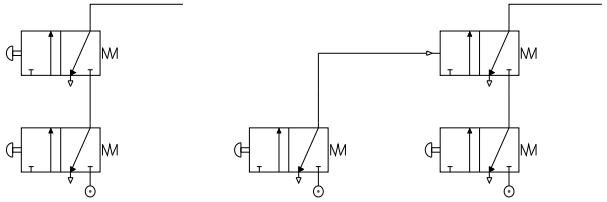
Question			Answer	Marks	Guidance
17	(a)				

Component name	Component symbol	Marks
A exhaust		
B pressure gauge [1]		1
C bi-directional restrictor		2
D cushioned [1] double acting cylinder [1]		2
E push button [1] valve [1]		2
F foot pedal operated spring return 3/2 valve		2

Question			Answer	Marks	Guidance
	(b)		The air flow through a bi-directional restrictor can be adjusted by tightening (1) or loosening (1) a bolt which closes down the airflow (1).	**3**	
	(c)	**(i)**	The regulator supplies air at a steady lower pressure than is held in the receiver tank.	**1**	Allow mark for understanding
		(ii)	The drain valve is in the receiver tank (1) at the lowest position in the tank (1).	**2**	
			Total	**15**	

Question			Answer	Marks	Guidance
18	(a)		 One possible answer Shaped to fit plate at **X** (1) (1) Lateral guides to cylinder Fixing at X shown (1) dropping (1) Wheel prevented from Overlap to cylinder top (1) Piston can instroke under Wheel	**6**	
	(b)	**(i)**	The cap head screw is the best choice because it can be tightened with a hexagon key which applies pressure to six surfaces rather than two (1). The hexagon key will give increased leverage when tightening the bolt (1).	**2**	No marks for aesthetic reasons.
		(ii)	Any one method: Spring washer, locking compound, star washer.	**1**	Allow any functional method that prevents bolt from vibrating loose.

Question			Answer	Marks	Guidance	
					Content	**Levels of response**
	(c)*		Discussion could include the following points: • there are fewer employees required for automated production than manual production, • this can lead to unemployment • fewer, more skilled employees, are required to maintain automation, • the initial costs of setting up and developing automation is high, • the running cost of automatic processes is lower than manual processes, • employees who are sick take more time to recover than fixing a machine, • productivity increases, • machines can work 24/7, • machines take no holidays. Allow marks for other suitable reasons.	**6**	Maximum of 2 marks for a bullet point list.	**Level 3 (5-6 marks)** Shows detailed understanding of the issues involved when automating processes and analyses most of the issues involved. Specialist terms will be used appropriately and correctly. The information will be presented in a structured format. The candidate can demonstrate the accurate use of spelling, punctuation and grammar. **Level 2 (3-4 marks)** Shows some understanding of the issues involved when automating processes with some analysis of the issues involved. There will be some use of specialist terms although theses may not always be used appropriately. The information will be presented for the most part in a structured format. There may be occasional errors in spelling, punctuation and grammar. **Level 1 (1-2 marks)** Shows limited understanding of the issues involved when automating processes. There will be little or no use of specialist terms. Answers may be ambiguous or disorganised. Errors of grammar, punctuation and spelling may be intrusive. 0 marks = no response or no response worthy of credit
			Total	**15**		

Question			Answer	Marks	Guidance
19	(a)		Use the formula F = P x A $100 = P \times (\pi \times 15^2)$ [1] $P = \frac{100}{\pi \times 15 \times 15}$ [1] $P = \frac{100}{707}$ [1] $P = 0.14 N/mm^2$ [1]	4	
	(b)	(i)	**AND** logic [1]	1	
		(ii)	2 Push button 3/2 valves used [1] Connection to form an AND gate [1]**.** 	2	Accept any functional arrangement.
	(c)		A + C+ B+ B – C – A– **or** end with A– C– [1] [1] [1] [1] [1]	5	

Question			Answer	Marks	Guidance
	(d)		A bi-directional restrictor will restrict the air in both directions causing the instroke to be slowed down as well as the outstroke (1). A uni-directional restrictor will allow free flow in one direction allowing the instroke to return quickly (1). The instroke is just returning the piston to the start position and so there is no need to slow it down; this will speed up the process if it returns quickly (1).	3	
			Total	**15**	

	Assessment Objective Grid			
GCSE Design & Technology: Pneumatics				
	Recall, select and communicate	Apply knowledge, understanding and skills	Analyse and evaluate	
Question	A01	A02	A03	Mark
1	1			**1**
2	1			**1**
3	1			**1**
4	1			**1**
5	1			**1**
6	1			**1**
7	1			**1**
8	1			**1**
9	1			**1**
10	1			**1**
11	1			**1**
12	1			**1**
13	1			**1**
14	1			**1**
15	1			**1**
16 ai		1		**1**
16 aii		1		**1**
16 aiii			1	**1**
16 bi	1			**1**
16 bii		1		**1**
16 biii		1		**1**
16 c		1	2	**3**
16 di		1		**1**
16 dii		3	1	**4**
16 e*	2	3	1	**6**
17 a	9			**9**
17 b	3			**3**
17 ci	1			**1**
17 cii	2			**2**
18 a	2	1	3	**6**
18 bi	1	1		**2**
18 bii	1			**1**
18 c	3		3	**6**
19 a	4			**4**
19 bi	1			**1**
19 bii	2			**2**
19 c	3		2	**5**
19 d	2		1	**3**
Total	**52**	**14**	**14**	**80**