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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Design and Technology (Systems and Control Technology) 3546

Foundation Tier

Mark Scheme

2008 examination - June series

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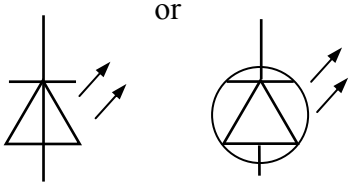
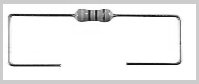
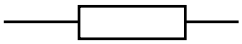
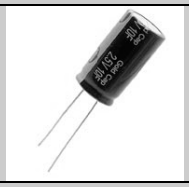
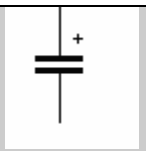
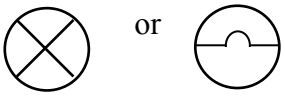
Registered address: AQA, Devas Street, Manchester M15 6EX *Dr Michael Cresswell Director General*

(3546) Foundation

Section A

1 This question is about making lights flash.

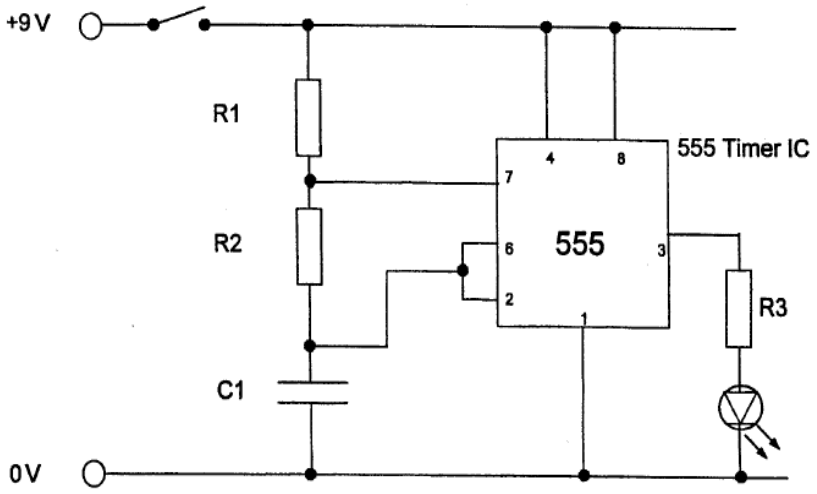
(a) Each of the illustrations below shows a component that can be used in circuits. For each illustration, name the component and draw the circuit symbol that represents it in a circuit diagram.
Some have been completed for you.

	Component	Symbol
	*LED*	or 
	Resistor	
	Capacitor	
	Lamp or Bulb (Not Light)	 or

(6 marks)

1

b The circuit diagram shown below will make the output flash.



(i) Circle one of the words below to show how the 555 timer is being used.

Astable. (1 mark)

(ii) Explain the purpose of the component labelled R3.

R3 *protects* the LED (1 Mark)

R3 *restricts the flow of current* to *prevent damage* to the LED (2 marks)

Max 2

(iii) Explain two changes that could be made that would change the flash rate of the output.

Two from R1, R2 or C1 could be changed for a different value (2 marks)

(5 marks)

Total 11 marks

2 This question is about switches and switching.

(a) In the box below, show how a switch could be added to the turnstile so that it operates once for each quarter of a revolution of the turnstile.

The switch is shown suitably fixed to the turnstile	(1 mark)	
The switch operates once for each quarter turn	(3 marks)	
The turnstile can operate the switch	(2 marks)	
An attempt has been made to describe a working system	(1 mark) Max 3	
Well drawn and well labelled	(2 marks)	
		(6 marks)

b	(i)	Suitable switch e.g. Microswitch, reed switch, PTM, PTB	(1 mark)	
	(ii)	Suitable advantage for the named switch e.g. Small and compact, easy to mount / operate	(1 mark)	
	(iii)	Digital	(1 mark)	
				(3 marks)
			Total	**9 marks**

3

(a) List two factors that you should think about when designing the automated mascot and give a reason why this is important. An example has been given.

Two suitable factors (2 x 1 mark)
e.g. Age, Power supply, Theme, Materials

Two suitable reasons - must support factors. (2 x 1 mark)
e.g. To suit age range of the visitors.

(4 marks)

(b) Complete the research plan opposite by adding suitable research sources and stating the information you would hope to find. The materials section has been completed for you.

Any suitable research sources and information you would expect to find.

Existing cartoon characters (2 marks)
e.g. the type and style of animal, motion paths
One word or very weak answer (1 mark)
Max 2

Existing Product Analysis (2 marks)
e.g. Size, Cost, Power requirements of mascot
One word or very weak answer (1 mark)
Max 2

Another suitable source (1 mark)
e.g. Web pages of rival theme parks

Information expected from this other suitable source (2 marks)
One word or very weak answer (1 Mark)
Max 2

(7 marks)

(c) Describe how the information from analysis and research may affect the final design.

Clear statement of intended use of information (2 marks)
e.g. The mascot is going to be in the shape of a Disney character, permission applied for.

Some intended use of information (1 mark)
e.g. Disney character Max 2

(2 marks)

(d) Give four design requirements for your automated mascot

Any **four** correctly indentified requirements. (4 x 1 marks)

e.g.

Appearance:	must be appealing to children
Materials	must be tough
Safety	must be safe
Durability	must be weather proof

Four correct explanations – must match above. (4 x 1 marks)

e.g.

Appearance:	in the shape of a cartoon animal
Materials	made from ABS plastic
Safety	must stop moving if obstructed
Durability	made use waterproof fittings

(8 marks)

Total 21marks

4 Study the information given in your design specification from Question 3.
Use this information to sketch two different designs for an automated mascot for the theme park.

Quality of ideas:

Mark **each** idea separately against the following scheme

- Function e.g. waving at visitors (1 mark)
- Appearance e.g. cartoon bear (1 mark)
- Materials e.g. ABS plastic (1 mark)
- Safety e.g. Low voltage (1 mark)
- Durability e.g. No small parts (1 mark)
- Which parts move e.g. Arrows and labels (1 mark)

(2 x 6 marks)

Quality of evaluations:

Award up to **five** marks for **each** evaluation using the following scale:

- Function e.g. it does wave (1 mark)
- Appearance e.g. it is Yogi Bear (1 mark)
- Materials e.g. it is made from ABS (1 mark)
- Safety e.g. No parts which could come off (1 mark)
- Durability e.g. It is a robust design (1 mark)

(2 x 5 marks)

Quality of sketches:

Quality 3D sketches (2 marks)
Quality line sketches or an attempt at 3D sketches (1 mark)
Max 2

(2 marks)

Quality of notes:

Detailed explanation describing and qualifying several features (2 marks)
Simple notes describing the features (1 mark)
Max 2

(2 marks)

Total 26 marks

5 Using notes and sketches show clearly how an electronic sensing device could detect a visitor.

(a) Suitable system to detect a visitor

A fully workable recognisable sensor system e.g. LDR and potential divider	(4 marks)	
A recognisable sensor system e.g. LDR	(3 marks)	
A simple system that would work e.g. a switch pad under the visitor	(2 marks)	
An attempt at a workable system e.g. a switch, and LDR on its own	(1 mark)	***(4 marks)***

Quality of sketches:

Quality line sketches or an attempt at 3D sketches	(2 marks)	
Simple line sketches	(1 mark)	***(2 marks)***

Quality of notes:

Notes describing the features	(2 marks)	
Labelling	(1 mark)	***(2 marks)***

Using notes and sketches show clearly details of the system that moves the automated mascot.

(b) Suitable system to animate the mascot

• Fully workable solution including power source	(6 marks)
• The mascot should move continuously	(5 marks)
• The mascot moves in one direction	(4 marks)
• The mascot moves erratically / jams	(3 marks
• An attempt at a recognisable system	(2 marks)
• A recognisable component	(1 mark) Max 6

Details of the mechanism and motor OR pneumatic cylinder and valve(s)

• Shows power source	(2 marks)
• Shows mechanism or cylinder	(1 mark) Max 2

Show the paths of all movement.

• The paths of **<u>all</u>** movement shown	(2 marks)
• The path of **<u>some</u>** movement shown	(1 mark) Max 2

(10 marks)

Quality of sketches:

Quality line sketches or an attempt at 3D sketches (1 mark)

Quality of notes:

Notes describing the operation (1 mark)

(2 marks)

Total 20 marks

6

(a) Complete the flowchart below for the roller coaster control process.

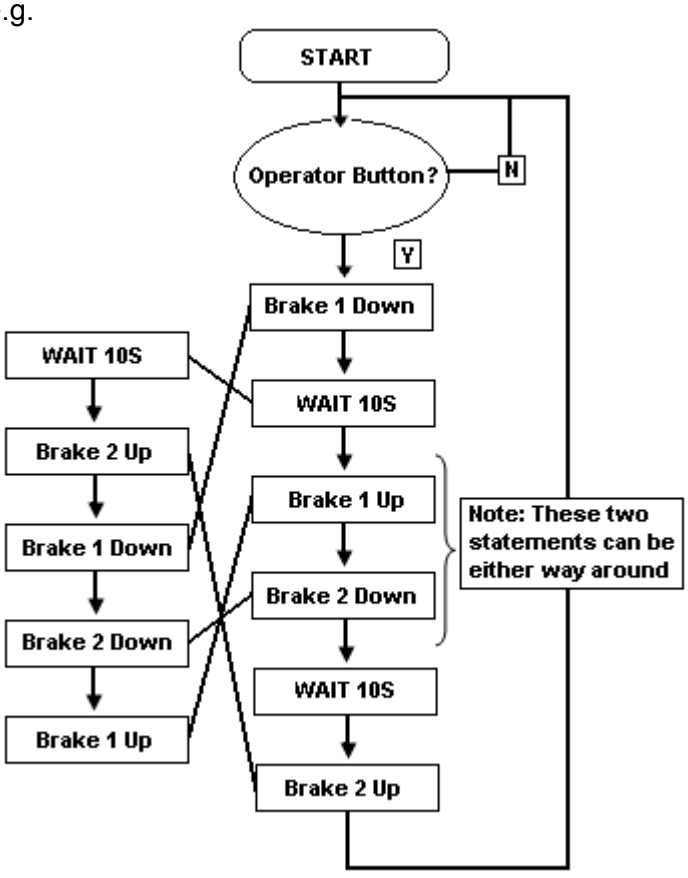
Marks will be awarded for:

Each correct output state of the decision boxes (2 marks)

Each statement in the correct box (4 marks)

Adding the missing arrow (1 mark)

e.g.



(b) Why is the time delay required?

To prevent Car 2 from hitting Car 1. (2 marks)

To prevent cars crashing (1 mark)

Total 9 marks

7 (a)

(i) Name a suitable material from which the duck targets could be made.

Any suitable specific material e.g. steel (1 mark)

(ii) Explain why this material is suitable for a target.

Any suitable explanation e.g. it is durable (not "strong") (1 mark)

(2 marks)

(b) Add a suitable pneumatic or mechanical system to the drawing above in Space A that will move the target left and then right continuously.

Marks will be awarded for a suitable system:

- that would move the target left and right (3 marks)
- that would move the target (2 marks)
- a recognisable system (1 mark)

Max 3 ***(3 marks)***

Marks will be awarded for a suitable mounting of the system:

- Suitable mounting at floor and target e.g. clevis and pin (2 marks)
- One suitable mounting or both connected (1 mark)

Max 2 ***(2 marks)***

Marks will be awarded for a system which is suitably powered e.g. motor or air supply ***(1 mark)***

Draw and label all components and mountings

Labelling or describing of components (1 mark)
Labelling or describing of mountings (1 mark) ***(2 marks)***

Total 10 marks

8 This question is about health and safety for a roller coaster system.

(a) List three risks that an error in the roller coaster system could cause.

Three relevant risks from a **system** failure.
e.g.
- Cars could collide
- Cars could go to quickly
- Cars could come off the track

(3 marks)

(b) List two safety checks the operator should do every morning before the public uses the ride.

Two suitable checks.
e.g.
- Check the track for obstructions
- Check all sensors are working correctly

(2 marks)

(c) Suggest how passengers could escape safely from the carriage if the ride stops at the top.

A suitable suggestion well explained e.g.
- There could be ladders built into frame (2 marks)

A suitable suggestion e.g.
- A ladder (1 mark)

(2 marks)

(d) State two regular maintenance operations of the roller coaster.

Two suitable maintenance operations of the roller coaster.
e.g.
- Check the brake pads/track for wear
- Check the sensors are in tolerance
- Paint the frame
- Oil and grease moving parts
- Torque up screws and bolts

(2 marks)

Total 9 marks

9

(a) Draw a cam mechanism in Box A that will make the bat move up and down continuously

a A correctly drawn egg / pear / eccentric shaped cam on dwell (4 marks)
A correctly drawn cam (3 marks)
A cam with errors that would rotate e.g. snail, multi lobe (2 marks)
A cam / crank that would not turn (1 mark) ***(4 marks)***
Max 4

(b) In use the follower was found to stick in the bearing blocks. Modify the end of the follower to prevent it sticking during use.

A flat or wheel added to the base of the follower (1 mark) ***(1 mark)***

(c) State the type of gear system shown above.

Simple (1 mark) ***(1 mark)***

(d) The motor spins at 100 revolutions per minute (rpm).

Formula:

Gear Ratio = $\frac{\text{Driven Gear}}{\text{Driver Gear}}$ (1 mark)
Working = $\frac{32}{16}$ = 2:1 (1 mark)

OR OR

Output Speed = Input Speed/Velocity Ratio (1 mark)
Working: = 100 / 2 (1 mark)
Max 2

Result 50 (1 mark)

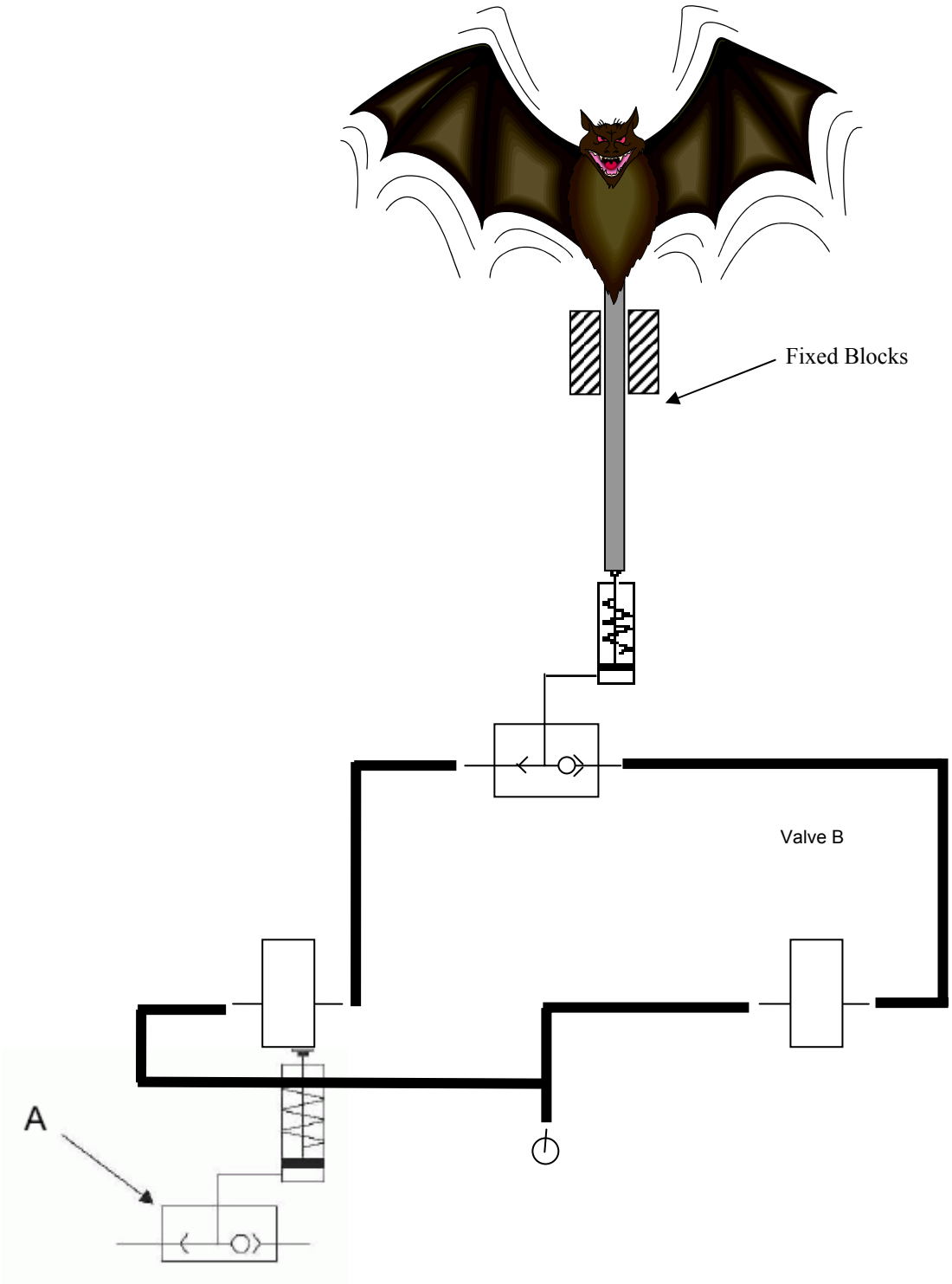
Unit RPM (1 mark) ***(4 marks)***

Total 10 marks

10

(a) Connect the components so that the bat goes up if either valve 1 or 2 is pressed.
1 mark for each correct airline

(4 marks)



(b) Name the component marked A in question 10 (a)
Shuttle Valve *(1 mark)*

(c) The input air pressure to the cylinder is 10 N / mm^2 and the area of the piston is 100 mm^2. Calculate the force of the output.

Formula:	Force = Pressure x Area	(1 mark)	
Working:	10 x100	(1 mark)	
Output Force and Units:	1000 N or 1kN	(2 marks)	*(4 marks)*

(d) Circle the type of cylinder shown above.
Double *(1 mark)*

Total 10 marks

Total for Paper 125 marks