GCSE

ELECTRONICS

44301

Mark scheme

4430
June 2014

Version: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

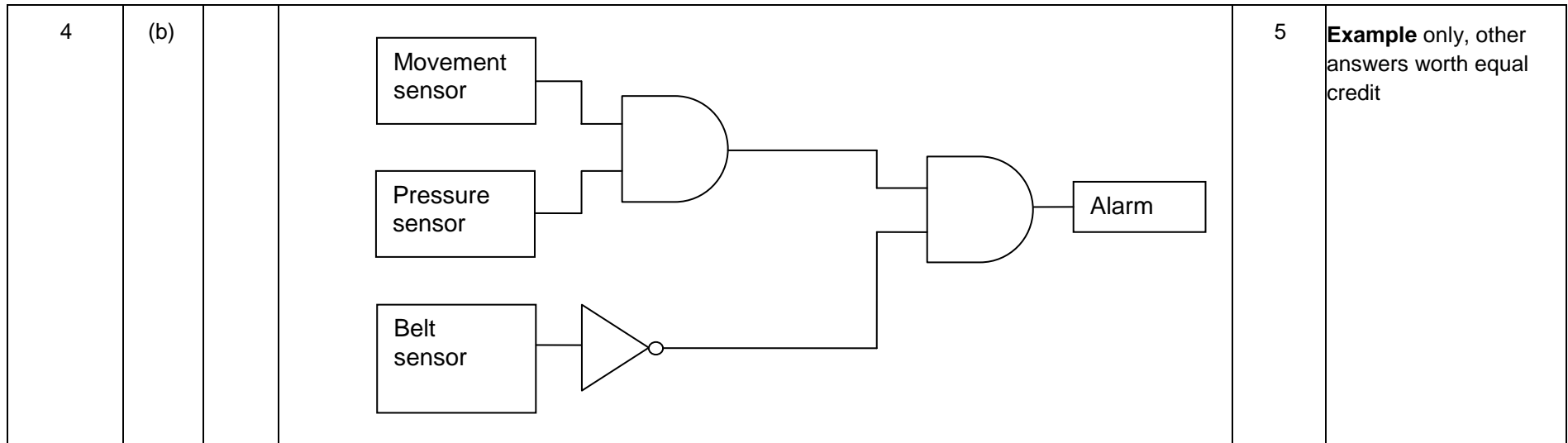Further copies of this Mark Scheme are available from aqa.org.uk
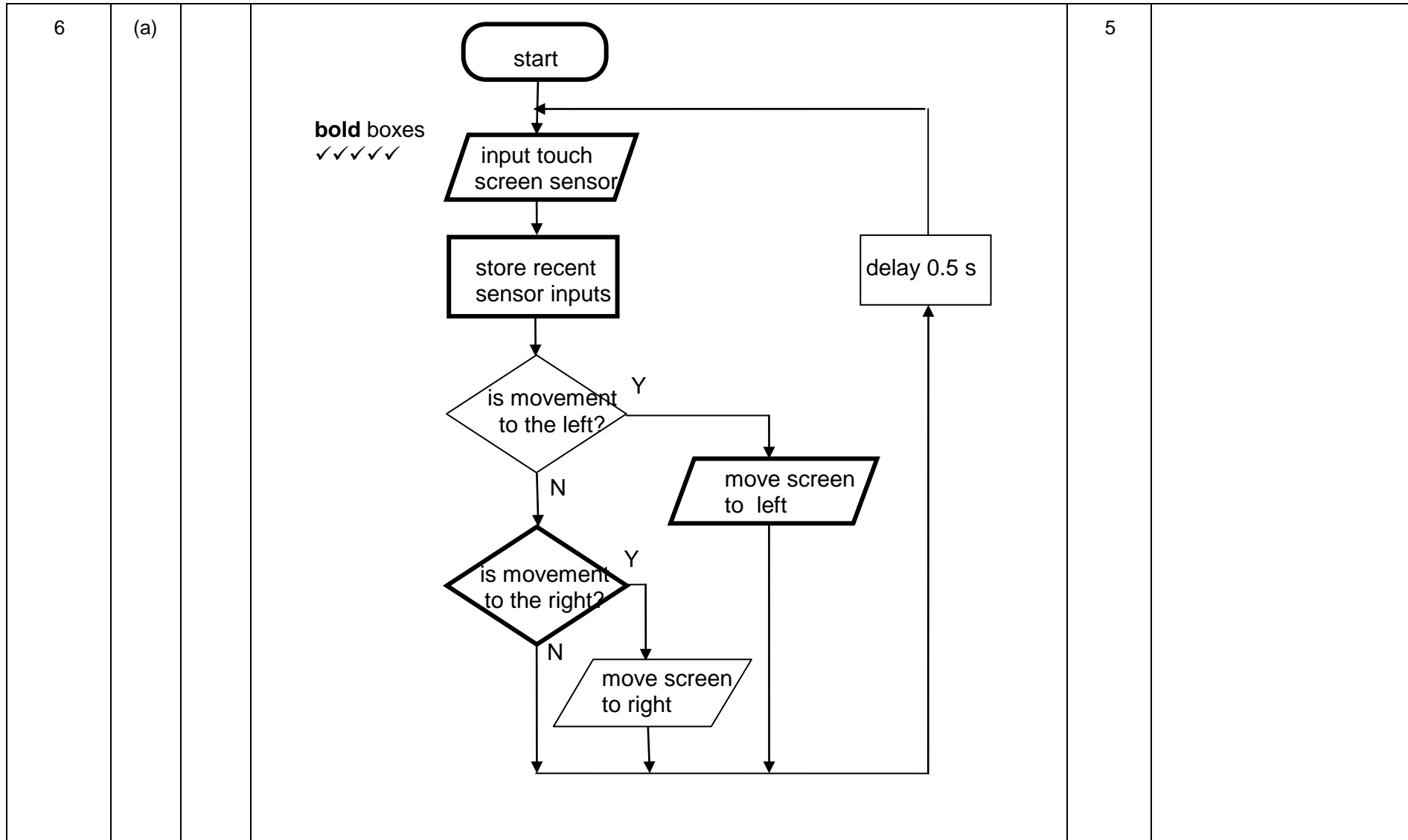
Component: 44301

Name: GCSE Electronics

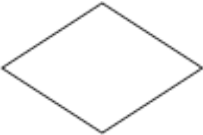| Question	Part	Sub Part	Marking Guidance	Mark	Comments
1	(a)		These answers are examples only, other answers will be worth **equal credit** Do not work alone✓ No-one to help or get help in an emergency✓ Do not work on circuits when switched on✓ Danger from heat or stored charge in components✓	4	
1	(b)		Isolating: no direct connection between primary and secondary✓ Step-down: secondary voltage lower than primary voltage✓ dc: current flows in one direction only **accept** direct current✓	3	
1	(c)		live✓ melts and breaks connection when current flow exceeds a certain level✓ fuse has to be replaced, circuit breaker can be re-set✓ fuse works on heat, circuit breaker magnetic✓	3 max	

| 2 | | | resistor✓ 270(Ω)✓ 5%(tolerance)✓
IC/ Integrated Circuit✓ logic✓ (D-type) Flip-Flop✓ or CMOS✓("D" shaped mark shows) pin layout/marks pin 1✓
capacitor✓ 22nF✓ 5% (tolerance)✓ 100V (wkg)✓ | 10 | |

| 3 | (a) | | (i) light sensor✓
(ii) piezo buzzer✓
(iii) astable✓
(iv) NOR gate✓
(v) comparator✓ | 5 | |

| 3 | (b) | | (i) light sensor/ first one/ input✓
(ii) comparator/ analogue to digital converter/ ADC/adc✓
(iii) astable/ pulse generator/ ✓
(iv) comparator/ analogue to digital converter/ ADC/adc ✓
(v)astable/ pulse generator ✓ | 5 | |

4	(a)				Movement sensor	Pressure sensor	Belt sensor	Alarm		5
					0	0	0	0		
					0	0	1	0	✓	
					0	1	0	0		
					0	1	1	0		
					1	0	0	0✓		
					1	0	1	0✓		
					1	1	0	1✓		
					1	1	1	0✓		

4	(b)				5	**Example** only, other answers worth equal credit
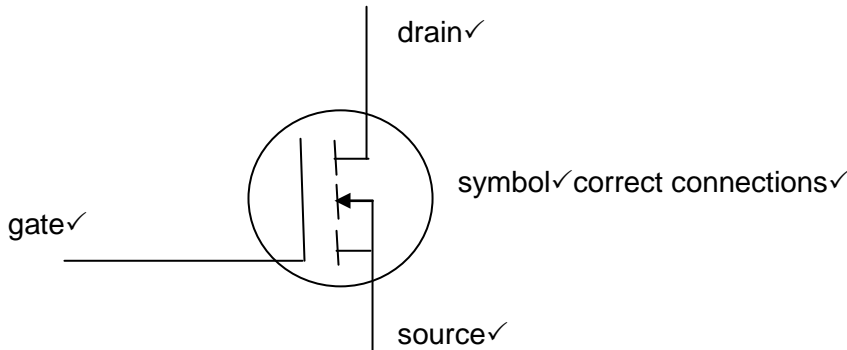
			1 NOT and 2 AND symbols ✓		
			AND movement and pressure ✓		
			Inverting belt ✓		
			AND the NOT and 1st AND outputs ✓		
			Last AND to alarm ✓		
5	(a)	(i)		1	

5	(a)	(ii)	series ✓	1	

5	(b)	(i)	$9 - 2.2 = 6.8(V)$ ✓	1	

5	(b)	(ii)	$6.8 / 0.02 / 20$ ✓ $= 340\Omega$ ✓	2	

5	(b)	(iii)	360Ω ✓ so LED current is not exceeded ✓	2	

5	(b)	(iv)	120Ω or e.c.f ✓	1	

5	(b)	(v)	parallel ✓ evidence of $1/680 + 1/680 = 1/340$ or equivalent ✓	2	

6	(a)			5	

bold boxes
✓✓✓✓✓

start

input touch screen sensor

store recent sensor inputs

delay 0.5 s

is movement to the left? — Y

is movement to the right? — Y

move screen to left

move screen to right

N

N

			Correct symbols and layout ✓ Input touch screen ✓ Are there two touches? ✓ Yes continue and no loop ✓ Fingers apart or together? ✓ Apart-increase size ✓ Together-decrease size ✓ Loop to start ✓		
6	(b)		decision box ✓ input box ✓ a loop is any line that returns to a point earlier in the flow chart✓ output box ✓ process box ✓	5	

| 6 | (c) | | | 8 | **Example** only, other answers worth equal credit |

Flowchart:

input touch screen

store recent sensor

are there two touches? — N → delay 0.5 s

Y

are touches moving apart? — Y → increase image size

N

are touches moving closer? — Y → decrease image size

N

7	(a)	(i)	(rf) tuned circuit✓ (audio) (af) amplifier✓	2	
7	(a)	(ii)	To receive radio waves✓and convert them into an electrical signal✓	2	
7	(a)	(iii)	To recover the audio signal✓ from the (modulated) carrier wave✓	2	
7	(a)	(iv)	Frequency (modulation)/ fm /FM✓	1	
7	(a)	(v)	A carrier wave at constant frequency ✓if also varying in amplitude at a frequency significantly lower than the carrier frequency✓	2	
7	(b)	(i)	2 squares✓ x 2ms✓ = 4 ms ✓	2	
7	(b)	(ii)	f = 1/T✓ = 1/0.004 = 250✓ Hz✓/ 1/4 = 0.25✓ kHz ✓	3	
7	(b)	(iii)	0.2 (V) ✓	1	
7	(c)		Y(voltage)-sensitivity/ vertical sensitivity/ y gain/ volts per division control ✓	1	
7	(d)	(i)	gain = V_{out}/V_{in} = 10/0.5✓ = 20✓	2	
7	(d)	(ii)	V_{rms} = V_P/1.4✓ = 7.14/7.07 (V)✓	2	

7	(d)	(iii)	The range of frequencies✓where the power gain is at least half the maximum gain/where it produces at least half of its rated output power(as spec.) ✓ (or equivalent using voltage 70%)	2	

8	(a)		The output resistance is low✓and the input resistance is high✓ **Alternative** if numerical values given: output resistance 1 000 000 ohms (or more) ✓input resistance 300 ohms (or less) ✓	2	

8	(b)	(i)	2✓ V✓words or use of formula✓	3	

8	(b)	(ii)	(+)6 (V)≥V≥ 4 (V)✓	1	

8	(b)	(iii)	0 (V)≤V≤2 (V)✓	1	

8	(c)	(i)		5	

drain✓

symbol✓correct connections✓

gate✓

source✓

8	(c)	(ii)	Level	Marks	Descriptor	5	QWC - Example
			3	4-5	an answer will be expected to meet most of the criteria in the level descriptor - answer is full and detailed and is supported by an appropriate range of relevant points such as those given below - argument is well structured with minimal repetition or irrelevant points - accurate and clear expression of ideas with only minor errors in the use of technical terms, spelling, punctuation and grammar		The diode protects the MOSFET.✓ When the current through the relay coil✓ is switched off✓ a high voltage is induced✓ which could damage the MOSFET. The diode provides a safe path for current. ✓
			2	2-3	- answer has some omissions but is generally supported by some of the relevant points below - the argument shows some attempt at structure - the ideas are expressed with reasonable clarity but with a few errors in the use of technical terms spelling, punctuation and grammar		
			1	0-1	- answer is largely incomplete, it may contain some valid points which are not clearly linked to an argument structure - unstructured answer - errors in the use of technical terms, spelling, punctuation and grammar or lack of fluency		

9	(a)	(i)				A	B	Alarm buzzer	3	
						1	1	0		
						1	1	1		
						1	1	0		
						1	1	1		
						0	0	0		
						0	0	0		
						0	1	0		
						0	1	1		
						✓	✓	✓		

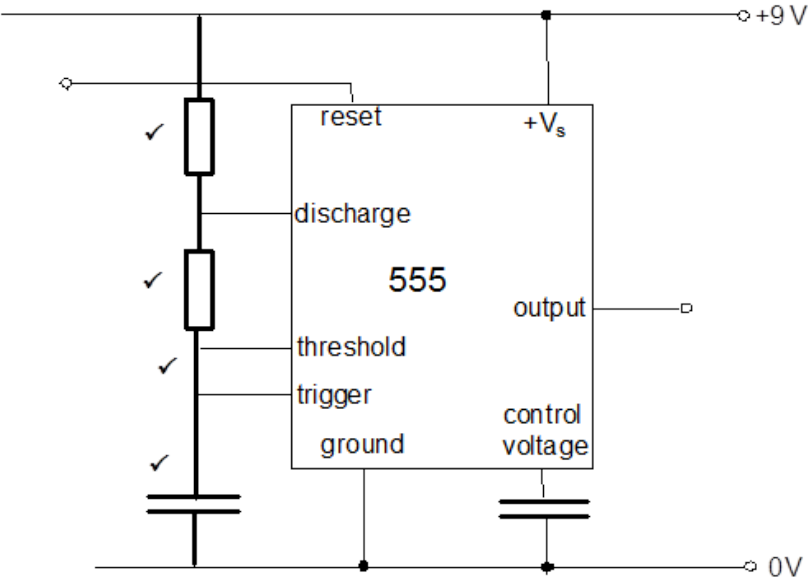| 9	(a)	(ii)	If either the guard is not in place✓ or the dust extractor is not working✓ or both✓ and the stone cutter is switched on✓	4	

9	(b)	(i)	D			S		1
						1		
						0		
						0		
						0 ✓		

9	(b)	(ii)				X	Y	Z	Alarm buzzer		4
						1	**0**	**1**	**0**		
						1	**0**	**0**	**1**		
						1	**0**	**1**	**0**		
						1	**0**	**0**	**1**		
						0	**1**	**1**	**0**		
						0	**1**	**0**	**0**		
						0	**0**	**1**	**0**		
						0	**0**	**0**	**1**		
						✓	✓	✓	✓		

| 9 | (c) | | | 7 | |

dust extractor
✓ signal
signal wire

+V_S

0 V

✓ output
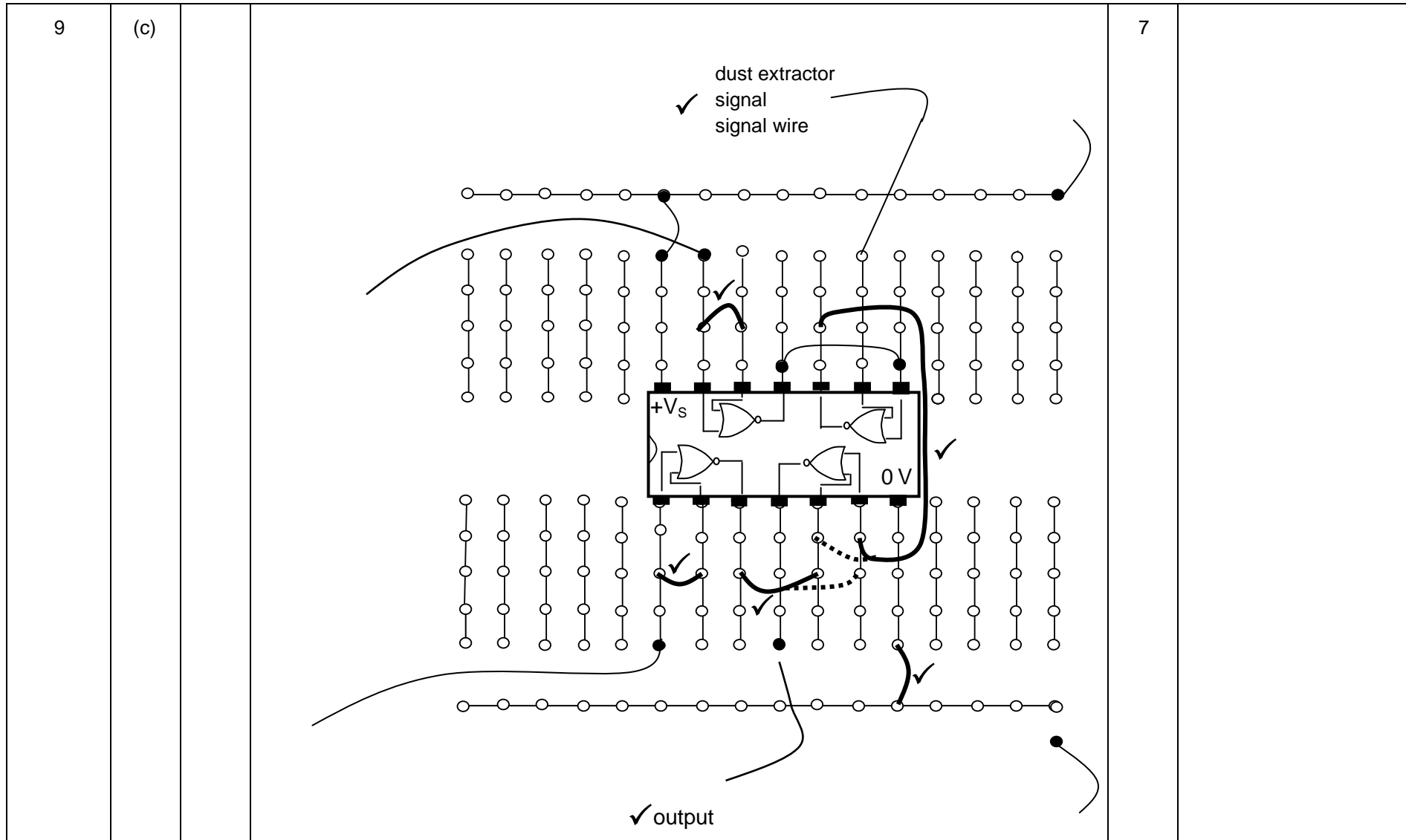
| 10 | (a) | (i) | monostable✓ | 1 | |

| 10 | (a) | (ii) | | 6 | |

| 10 | (b) | (i) | astable ✓ | 1 | |

| 10 | (b) | (ii) | | 4 | |

The circuit diagram shows a 555 timer with pins labelled: reset, discharge, threshold, trigger, ground on the left/bottom and +V_s, output, control voltage on the right. Connected to +9 V and 0 V rails. Check marks (✓) shown against two resistors, the capacitor connection, and the ground/capacitor.

| 10 | (b) | (iii) | $T = (R_1 + 2R_2)C/1.44$ ✓ $= (5.6 \times 10^3 + 2 \times 30 \times 10^3) \times 10 \times 10^{-6}/1.44 = 0.45$ (s) ✓ powers of 10 ✓ | 3 | |

| 10 | (c) | (i) | 3 LEDs connected to 0,1 and 2 outputs ✓✓✓ | 3 | (**minus 1** if LEDs wrong way round, **minus 1** if symbols incorrect but still recognisable) |

| 10 | (c) | (ii) | | 6 | |

✓ and correctly repeated