



National 5 Engineering Science Assignment Finalised Marking Instructions

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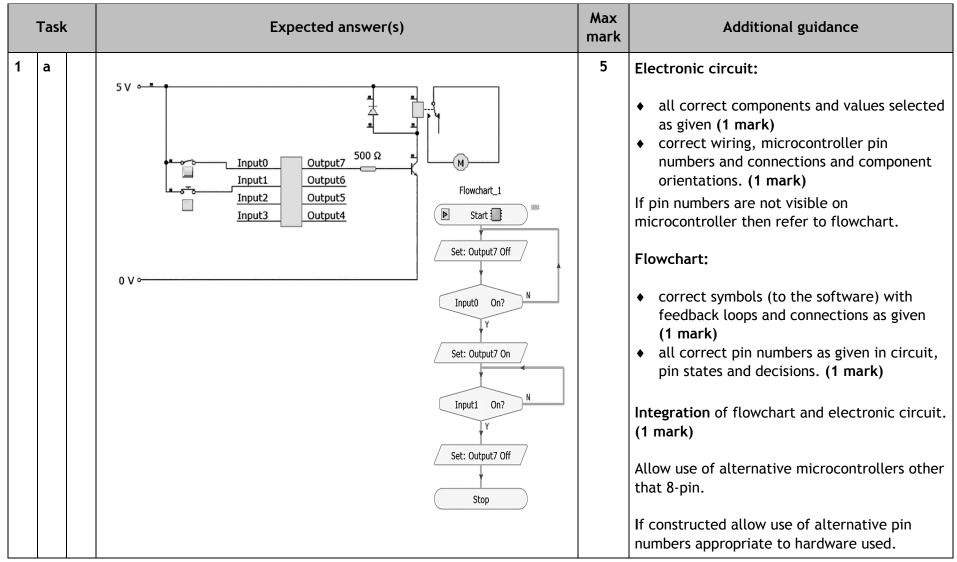
Marking instructions

General marking principles

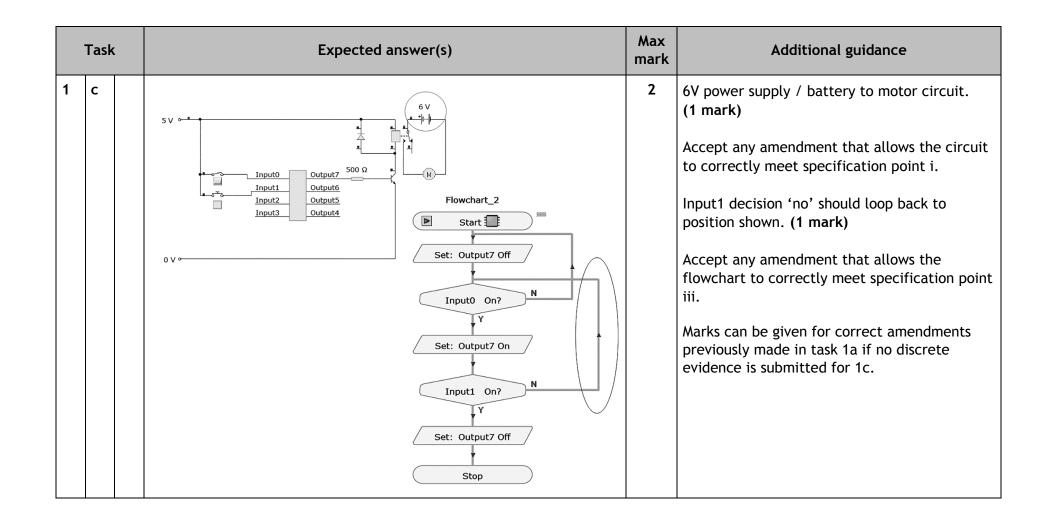
Always apply these general principles. Use them in conjunction with the detailed marking instructions, which identify the key features required in candidates' responses.

- a Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.
- b If a candidate response does not seem to be covered by either the principles or detailed marking instructions, and you are uncertain how to assess it, you must seek guidance from your team leader.





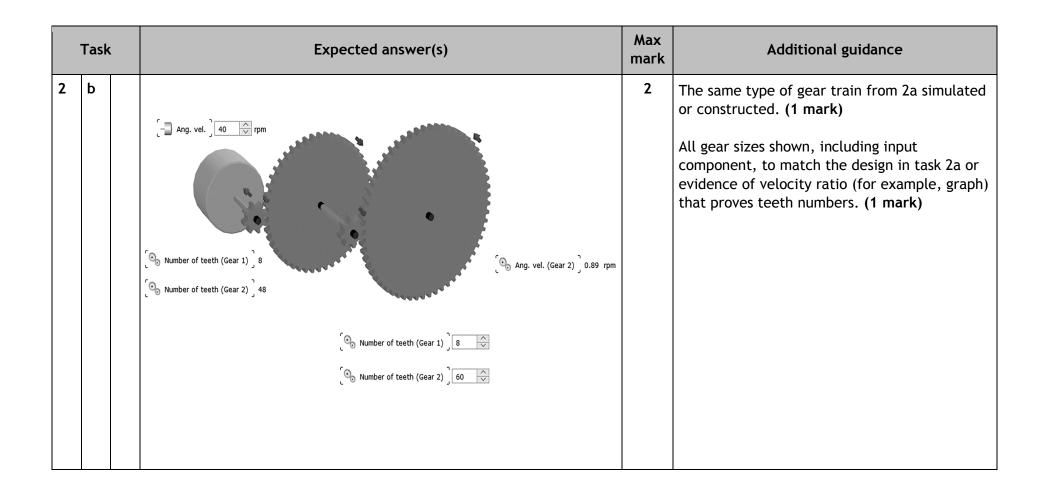
	Task			Expected a	inswer(s)		Max marl	Additional guidance
1	b		Planned test	Expected result	Initial test result	Amended test result	5	Must be descriptive responses. Not 'yes', 'no' or 'it worked' on its own.
			Test 1 Turn on the master switch.	The relay should activate and the motor should start turning.	The relay activated and the motor did not turn.	The motor turned on.		Award a maximum of 3 marks for initial test results from each test. Award a maximum of 2 marks for amended test results.
			Test 2 Turn on the master switch and then turn on the position sensor.	The motor should start turning then slow down and stop.	The motor turned on and then the motor turned off.	No change in results.		Take account of simulation or construction evidence from task 1a and 1c and allow FTE. FTEs should also be applied within each row. Test 1 initial result: relay activates and
			Test 3 Turn on the master switch and then turn off the master switch.	The motor should start turning then slow down and stop.	The motor turned on but did not stop.	The motor stopped.		motor does not turn on. Both the relay and motor must be referred to. (1 mark) Test 1 amended result: motor turns on. (1 mark) Test 2 initial result: motor turns on and then off. Both the motor turning on and off must be referred to. (1 mark)
								Test 2 amended result: no change in results. (1 mark)
								Test 3 initial result: motor turns on but does not stop. Both the motor turning on and not stopping must be referred to. (1 mark)
								Test 3 amended result: motor stops(1 mark)



Task	Expected answer(s)	Max mark	Additional guidance
1 d	<pre>main: label0: low 7 label1: if Input0 = 1 then label2 goto label0 label2: high 7 if Input1 = 1 then label3 goto label1 label3: low 7 end</pre>	1	Correct code and pin numbers to fully match the final flowchart. (1 mark) Accept manually written or automatically generated. Any high level language is acceptable.

	Task		Expected answer(s)		Additional guidance
1	e		 i Yes. When the master switch is pressed the motor turns on. ii Yes. When I activated the position sensor the motor turned off. iii Yes. When the master switch is released / pressed again the motor turns off. 	4	State whether specification point i was met with description referring to master switch and motor turning on. (1 mark) State whether specification point ii was met with description referring to position sensor and motor turning off. (1 mark)
			 Improvement: slow the motor down faster as the stage takes too long to stop use a more powerful motor to allow a heavier stage add emergency stops for the stage revolving for safety use a higher supply voltage to turn the stage motor faster. 		State whether specification point iii was met with description referring to master switch and motor turning off. (1 mark) Description of improvement to circuit or flowchart within the real concert venue. (1 mark) Apply FTE from task 1c.

Task	Expected answer(s)	Max mark	Additional guidance
2 a	8 teeth 60 teeth output 8 teeth 48 teeth	2	Compound gear train. (1 mark) Only accept use of worm and worm wheel as part of compound gear train. All gear sizes shown plus labelling input or implied (for example, through inclusion of motor or calculations or output labelled) that will give a speed reduction of at least a factor of 40. (1 mark) Award only 1 mark if simple gear train shown with a speed reduction of at least a factor of 40. If simulated (0 marks).



	Task		Expected answer(s)						Additional guidance
2	2 C		Planned test	Input speed	Output speed	Required velocity ratio	Actual velocity ratio	2	Input/output speeds: Complete table with correct output speed for teeth numbers given in 2b. (1 mark)
			Measure the input speed and output speed of the gear system and calculate the actual velocity ratio.	40	0.89	At least 40 (40 : 1)	45 : 1		If no teeth numbers indicated on task 2b refer to 2a. No evidence of simulation or construction in task 2b. (0 mark) Units not required. Accept number of turns.
									Velocity ratio: Correct value/ratio for given input and output speeds. (1 mark) If no input and output speeds have been entered VR can be derived from 2b or 2a.
2	d		 i Yes. The output speed was 45 times slower than the input speed which is more than a factor of 40. ii Yes. A compound gear train allows it to fit into a compact space as required. 				2	State whether specification point i was met with description referring to (output) speed and speed reduction equal to or greater than 40 (comparison). (1 mark) State whether specification point ii was met with description referring to compound arrangement / limited number of gears / size of gears and small space / under stage. (1 mark) Evaluation should be based on 2c, or in its absence 2b, or in its absence design in 2a.	

	Task			Expected answer	Max mark	Additional guidance	
3	a					4	Test referring to safety guard / plunger and
			Spec. point	Planned test	Expected result		up button. (1 mark) Result referring to piston staying instroke or
			i	Activate the safety guard and push the up button at same time.	The piston should outstroke and the stage will move up.		stage down. (1 mark) Do not accept "nothing happens". Test referring to down button / button 1 / button 2 pressed. (1 mark)
				When the stage is down, push the up button without the safety guard being activated.	The piston should not outstroke / the stage does not move.		Accept both buttons. Result referring to piston instroke or stage down. (1 mark)
			ii	Activate down button 1 / down button 2 / either down button.	The piston should instroke and the stage will move down.		Responses must be descriptive.
				When the stage is up, activate down button 2 on ground level.	The piston should instroke / the stage will move down.		

	Task	Expected answer(s)	Max mark	Additional guidance
3	b	Example 1 Slow down the speed of the piston.	3	Description of suitable improvement to the pneumatic circuit. (1 mark)
		This would make the platform safer for the people standing on it. Uni-directional restrictor.		Justification for improvement in terms of safety (FTE). (1 mark)
		Example 2 Add a safety guard for when the stage is going down.		Not "safer" on its own. Must refer to context of real concert venue. Suitable, correctly named, pneumatic
		The stage will not move down when people are standing underneath it and harm them.		component(s). (1 mark)
		Plunger 3/2 spring return valve.		
3	c		3	Piping of 3/2 valve A to shuttle including main air. (1 mark) Piping of 3/2 valve B to shuttle including main air. (1 mark) Piping of shuttle valve to single acting
				cylinder. (1 mark) Accept use of any 3/2 valve actuator.

Task	Task		Expected answer(s)		Additional guidance
4				4	 Four LEDs drawn with correct symbol and orientation. (1 mark) All LEDs drawn in parallel (FTE). (1 mark) Protective resistor(s) with correct symbol to protect all LEDs. (1 mark) Accept single protective resistor before or after all LEDs or resistors on each LED branch. One SPST switch with correct symbol drawn in suitable position. (1 mark) Accept simulation. Ignore any values. If any additional components / wires affect the operation of LEDs then max. 3 marks.

	Task		Expected answer(s)		Additional guidance
5	a	i	user input ————————————————————————————————————	2	User input action / pressure identified and in the correct position with arrow. (1 mark) Light and sound /noise outputs identified and in the correct position with arrow(s). (1 mark) Award only 1 mark if all correct inputs and outputs but without arrows. Ignore boxes, extra boxes or words.

Task	Expected answer(s)	Max mark	Additional guidance
Task 5 a 1 <th>Expected answer(s)</th> <th></th> <th>Additional guidance(Master) switch connected to microcontroller in correct position. (1 mark)Do not accept switch as feedback sensor.One driver per output device individually connected to microcontroller. (1 mark)Lamp connected in output position. (1 mark)Siren connected in output position. (1 mark)System boundary around sub-systems only and boxes around each sub-system. (1 mark)Do not accept 'light', 'bulb' or 'LED' instead of 'lamp'.Do not accept an action (e.g. lamp on).Ignore extra sub-systems.If no arrows shown, assume left to right.</br></th>	Expected answer(s)		Additional guidance(Master) switch connected to microcontroller in correct position. (1 mark)Do not accept switch as feedback sensor.One driver per output device individually connected to microcontroller. (1 mark)Lamp connected in output position. (1 mark)Siren connected in output position. (1 mark)System boundary around sub-systems only and boxes around each sub-system. (1 mark)Do not accept 'light', 'bulb' or 'LED' instead

 b c b c c start f pin 0 / master switch decision with Y or N and loop. (1 mark) Pin 7 / lamp high and low and both 0.5 s delays. (1 mark) x 10 decision and correct entry. (1 mark) Pin 6 / siren high and low and 5 s time delay and sequence ending. (1 mark) Accept pin 7 / lamp high and low and time 0.5 s delays repeated 10 times. Can be manually drawn or produced on simulation software. Flowchart may refer to pin numbers from task 5b or could be descriptive. lignore additional stages. 		Task	Expected answer(s)	Max mark	Additional guidance
Pin 6 low end	5	b	is pin 0 on? Y pin 7 high Wait 0.5 seconds Wait 0.5 seconds Has been done 10 times? Y pin 6 high Wait 5 seconds Pin 6 how Pin 6 low	4	 and loop. (1 mark) Pin 7 / lamp high and low and both 0.5 s delays. (1 mark) x 10 decision and correct entry. (1 mark) Pin 6 / siren high and low and 5 s time delay and sequence ending. (1 mark) Accept pin 7 / lamp high and low and time 0.5 s delays repeated 10 times. Can be manually drawn or produced on simulation software. Flowchart may refer to pin numbers from task 5b or could be descriptive.