

Electronics Unit 2 Test 4

Name	
Number	

You have addressed the skills being assessed in this Test.

Recognise the op-amp as a voltage comparator.	
Recognise the op-amp as an inverting amplifier.	
Explain the properties of the inverting amplifier.	
Explain the concept of virtual earth.	
Calculate the gain of an inverting amplifier.	
Recognise the non-inverting amplifier.	
Calculate the gain of a non-inverting amplifier.	
Compare the input resistance of the inverting and non-inverting amplifier.	

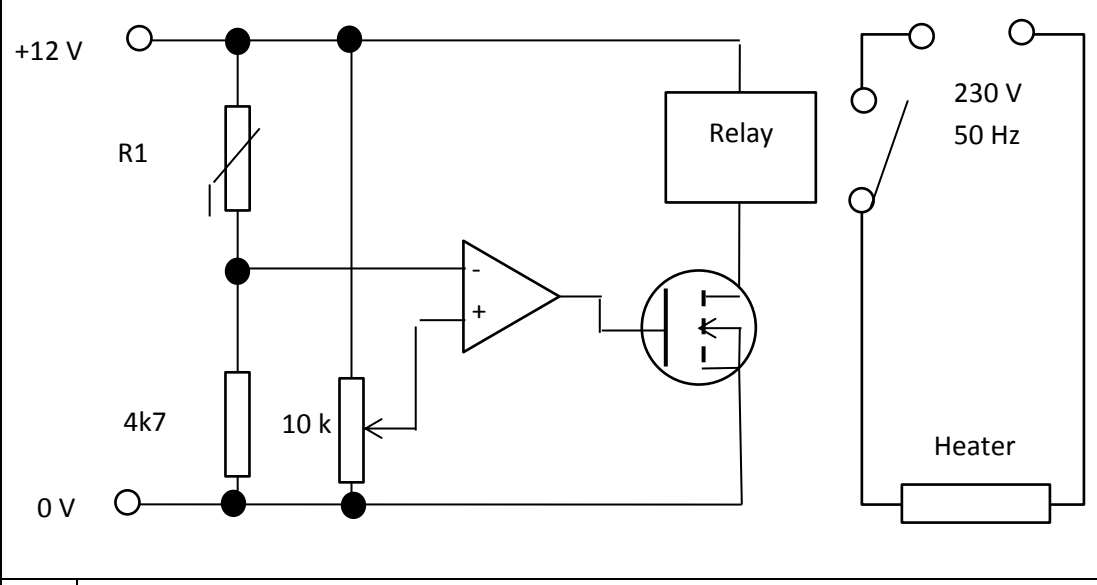
There are things that you need to do to improve your work:

Ensure that you use good English...	
...and clear presentation.	
Correct use of technical terms.	
Not to leave questions un-attempted.	
Show your working out fully.	
Include units as part of your final answer	

<p>Comment:</p>

<p>Mark: ____ / 45</p> <p>Grade: _____</p> <p>MTG: _____</p>
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1. The circuit below shows a simple thermostat circuit to control temperature in a greenhouse



(a) Complete the sentence: 1

The op-amp is being used as a _____

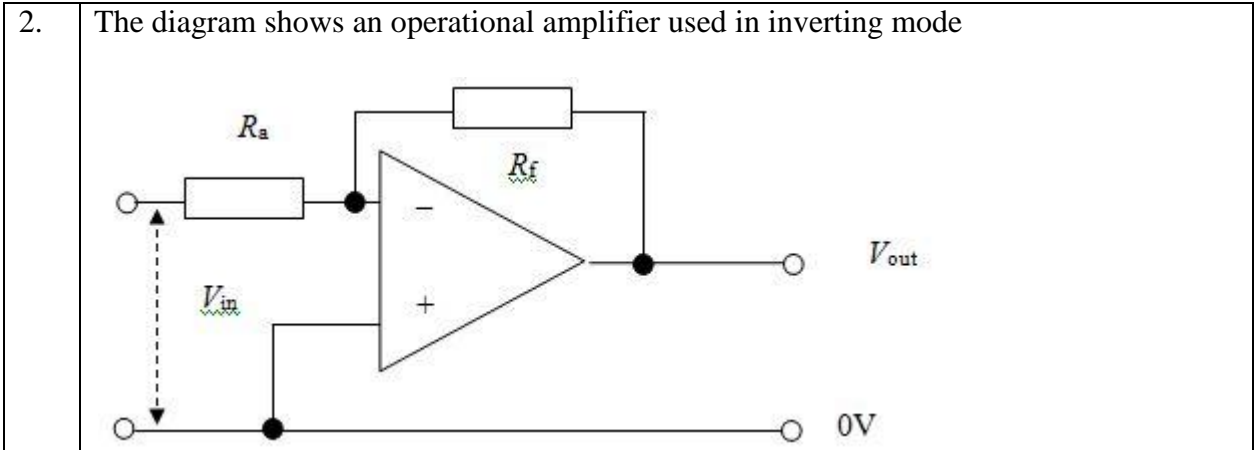
(b) In the space below draw a system diagram for the circuit. One box has been completed as an example. 5



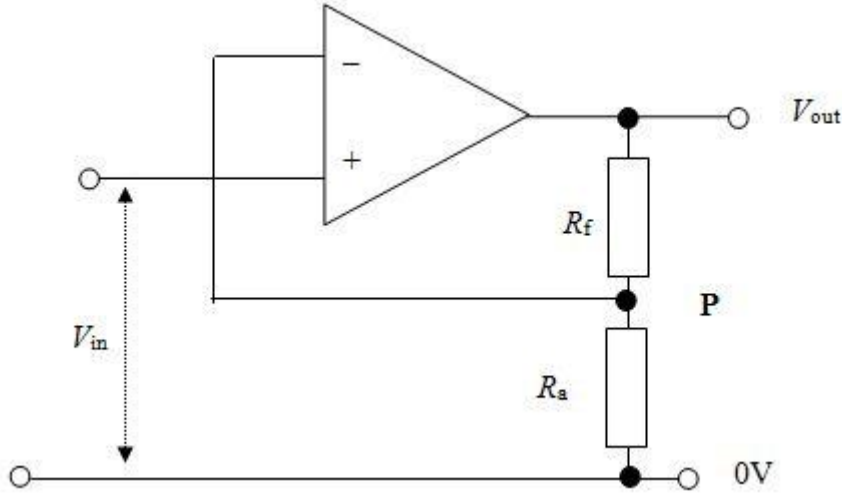
(c) Complete the circuit diagram by adding a component that will protect the MOSFET. 3

(d) Explain why the component you have just added is needed. 2

	(e)	At a certain temperature the resistance of the thermistor is 7.0 kilohms. Calculate the voltage at the inverting input.	2
	(f)	What is the voltage at the non-inverting input? Explain your answer.	2
	(g)	When the greenhouse is cold, explain how the heater comes on.	3
	(h)	When the greenhouse is warm, explain how the heater remains switched off	3



(a)	On the diagram, draw a line to show where the current flows.	2
(b)	State what assumption you made, giving a reason	2
(c)	Explain what is meant by a <i>virtual earth</i> .	2
(d)	The amplifier has $R_a = 2.2 \text{ k}$ and $R_f = 820 \text{ k}$. If the input voltage = 6 mV , calculate the output voltage.	3
(e)	The amplifier has a unity gain bandwidth constant of 125 000. What is the bandwidth?	2
(f)	In the space below, sketch the sinusoidal input waves and the output waves to show the phase difference.	2
	<div style="text-align: center;"> <p>Voltage</p> <p>Time</p> </div>	

3.	<p>The circuit diagram shows a non-inverting amplifier.</p> 	
(a)	Explain why this circuit uses negative feedback.	2
(b)	Calculate the voltage gain if $R_a = 33\text{ k}$ and $R_f = 270\text{ k}$.	2
(c)	A 100 k resistor is placed in series with the non-inverting input. Explain what difference, if any, will be made to the gain of the amplifier.	3
(d)	With reference to the input resistance and phase, explain the advantage of using a non-inverting amplifier to an inverting amplifier.	4
Total = 45 marks		

End of Examination.

Now go back and check your work.