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# A-LEVEL PHYSICS

7408/3BE: Paper 3B Electronics  
Report on the Examination

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7408  
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## General Comments

It was felt that the general standard of the paper was similar to that seen in previous series and it produced a very good spread of marks across the candidature. The mark scheme was applied in such a way as to make multiple-mark questions accessible to a wider range of student abilities.

### Question 1

- 01.1** Only half of the students achieved full marks on this item. This would suggest that, although many students understood the basic operation of the counter, a significant number were not confident in translating that knowledge into a timing diagram.
- 01.2** Answers from a pleasingly large number of students indicated their sound understanding of the counter in the set context.
- 01.3** Around 45% of the students were able to pick up one mark on this item, with approximately another 32% of students getting the two marks. The most popular wrong answer was to reference the propagation delay of the gates.
- 01.4** This item produced a good spread of marks with students tripping up at different stages of the calculation.  
Common mistakes were:
- not appreciating that  $V_R = 6.9 \text{ V}$
  - not using the percentage error range for the resistor
  - using the wrong end of the percentage tolerance range to justify the answer.

### Question 2

- 02.1** The mode of operation for this operational amplifier was correctly identified by about 80% of the students. Students should be able to identify the five basic configurations of the operational amplifier as part of the core knowledge in this option.
- 02.2** This was a basic calculation and the equation was supplied in the Data and Formulae Booklet. Only a few students were unable to identify the input and feedback resistors with the circuit acting as a simple inverter. More students failed to gain the second mark by not transferring the negative sign in their working to the final answer line.
- 02.3** This question proved to be a good discriminator. A few students failed to gain marks due to a lack of clarity in their extended written responses. '*Subtraction of the signals*' was a phrase which did not always get used, even by those who had correctly identified the mode of operation of the circuit.

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### Question 3

- 03.1** This was an unusual graph, but something that can be found as part of the data sheet for a probe. As such, the interpretation of the data from this type of graph is regarded as a key skill. Only the top 8% of students were able to gain all three marks. The more difficult mark was gained by those who discussed the lack of reliability in the 'north pole facing' arrangement across the 2.5 - 15 mm range.
- 03.2** This question also provided good discrimination. However, there were a significant number of students who failed to extract the correct information from the graph. These appeared to be split between those who were unfamiliar with the grid and the use of the time base (perhaps not having used a cathode-ray oscilloscope), and those who could not relate the trace to the rotating vane.  
Credit was given for a correct calculation made from incorrect readings from the trace.

### Question 4

- 04.1** Only the more able students managed to generate a characteristic which was in keeping with the technical data for the component.
- 04.2** This mark was achieved by around 60% of the students. Some students used the term 'regulator' which was accepted as a very loose term in this context. (The term 'regulator' is more correctly used to explain the stabilisation of the voltage under different loading conditions.)
- 04.3** Students were expected to first check that a 100  $\Omega$  resistor would be suitable and then to check to see if the power rating was suitable. Students approached this in a number of ways, some of which changed the point of the question. Credit was given where a clear explanation / justification was provided of the approach adopted.
- 04.4** This was a difficult question as it required students to understand fully the basic operation of the op amp as a comparator, and to understand the action of an LDR together with its effect on a potential divider. An encouraging 65% of students were able to gain marks from this item.
- 04.5** Almost 80% of students were able to gain the mark for this question. Due to the way that the question was phrased, transformation alternatives were accepted. However, it should be noted that students should be encouraged only to **use the functions shown in the diagram**.
- 04.6** Questions of this nature will only expect students to consider:
- the relatively high gate voltage needed to switch on the MOSFET
  - the high input resistance which eliminates loading of the logic gate output.

### Question 5

The extended-prose item is intended to test the understanding and use of technical terms and techniques (knowledge), as well as the ability to produce clear and logical explanations. This question produced a wide spread of marks, although only 35% of students gained three marks or better.

**PCM** is well documented in the guidance notes under ‘communications’ and is an extension of the ‘analogue and digital signals’ section which deals with ADC.

**Multiplexing** was understood at a general level.

Many students did not take the ‘**Regeneration**’ concept any further than to repeat the information in the question.

Knowledge of the analogue modulation techniques such as PAM, PWM, PTM or PPM was not, and is not, required.

### **Mark Ranges and Award of Grades**

Grade boundaries and cumulative percentage grades are available on the [Results Statistics](#) page of the AQA Website.