Captivate
EDUCATION

SAMPLE QUESTIONS
One question from each section of this exam, with its marking scheme, so teachers can see what the full paper is like. Full exam and solutions: captivateeducation.com.au/trial-exams

Systems Engineering

Question and Answer Book

Practice examination 1 – 2027

- Reading time is 15 minutes
- Writing time is 1 hour 30 minutes

Approved materials

- One scientific calculator

Materials supplied

- Question and Answer Book
- Detachable Formula Sheet in the centrefold
- Multiple-Choice Answer Sheet

Instructions

- Follow the instructions on your Multiple-Choice Answer Sheet.
- At the end of the examination, place your Multiple-Choice Answer Sheet inside the front cover of this book.
- Detach the Formula Sheet from the centre of this book during reading time.

Students are not permitted to bring mobile phones and/or any unauthorised electronic devices into the examination room.

Contents

Section A (20 questions, 20 marks)

Section B (13 questions, 80 marks)

Practice material in the layout of the 2025 VCAA paper – generated 2027. Not a VCAA examination.

SAMPLE

Section A – Multiple-choice questions

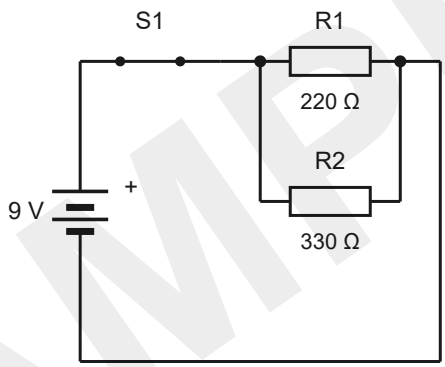
Instructions

- Answer **all** questions in pencil on your Multiple-Choice Answer Sheet.
- Choose the response that is correct or that best answers the question.
- A correct answer scores 1; an incorrect answer scores 0.
- Marks will not be deducted for incorrect answers.
- No marks will be given if more than one answer is completed for any question.
- Unless otherwise indicated, the diagrams in this book are not drawn to scale.

Sample – Question 1 of the 20 questions in this section.

Question 1

When switch S1 is closed, the total resistance of the circuit shown below is



A. 7.58 mΩ

B. 132 Ω

C. 275 Ω

D. 550 Ω

End of Section A

SAMPLE

Section B

Instructions

- Answer **all** questions in the spaces provided.
- Write your responses in English.
- All calculations must show appropriate formulas and working.

SAMPLE

- Unless otherwise indicated, the diagrams in this book are not drawn to scale.

Sample – Question 1 of the 13 questions in this section; Question 1 is shown to part c of its 4 parts.

Question 1 (6 marks)

The heating element of an egg incubator on a school farm is made from three resistors, R1, R2 and R3, connected to a 24 V DC supply as shown in Figure 1. An ammeter measures the supply current and a voltmeter is connected across R1.

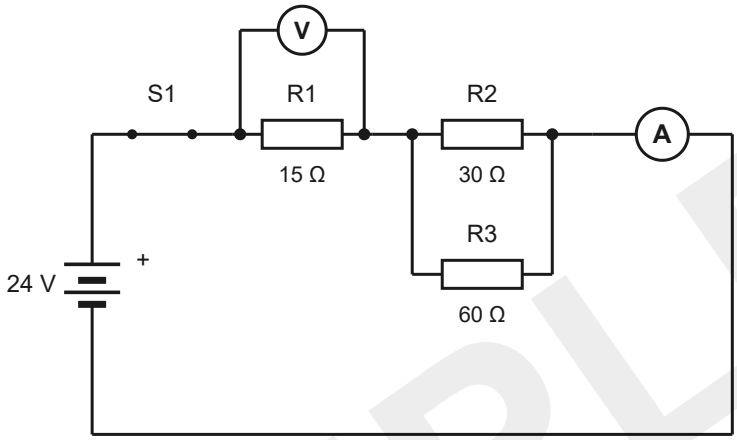


Figure 1

a. Calculate the total resistance of the circuit when switch S1 is closed. Show your working. 2 marks

Ω

b. Calculate the reading on the ammeter. Show your working. 2 marks

mA

SAMPLE

c. Calculate the reading on the voltmeter. Show your working. 2 marks

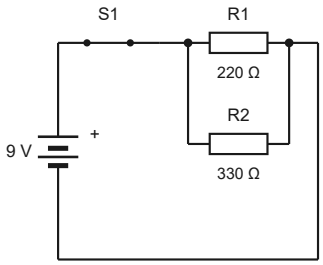
V

End of sample questions

SAMPLE

Marking scheme for the sample questions

Section A

Question	Key	Question	Why
1	**B**	When switch S1 is closed, the total resistance of the circuit shown below is 	R_t = (220 × 330)/(220 + 330) = 132 Ω. 550 Ω results from adding the resistors as if in series; 275 Ω is their mean; 7.58 mΩ comes from not taking the reciprocal of $1/R_1 + 1/R_2$.

Section B

Question 1a. (2 marks)

Calculate the total resistance of the circuit when switch S1 is closed. Show your working.

To be awarded full marks, students were required to:

Combine the parallel pair first and then add the series resistor.

> $R_{2,3} = (R_2 \times R_3)/(R_2 + R_3) = (30 \times 60)/(30 + 60) = 20\ \Omega$
> $R_t = R_1 + R_{2,3} = 15 + 20$
> $R_t = 35\ \Omega$

Adding all three resistors (105 Ω) treated the parallel pair as series resistors.

Mark allocation: 1 mark for the parallel combination (20 Ω); 1 mark for 35 Ω.

Question 1b. (2 marks)

Calculate the reading on the ammeter. Show your working.

To be awarded full marks, students were required to:

> $V = IR$, so $I = V/R_t$

SAMPLE

$$I = 24/35$$
$$I = 0.686\ A = 686\ mA$$

Writing 0.686 in a box printed mA was not accepted.

Mark allocation: 1 mark for the substituted formula; 1 mark for 686 mA. Consequential on part a.

Question 1c. (2 marks)

Calculate the reading on the voltmeter. Show your working.

To be awarded full marks, students were required to:

$$V_{R1} = I \times R_1$$
$$V_{R1} = 0.6857 \times 15$$
$$V_{R1} = 10.3\ V$$

Giving 24 V (the supply) or 12 V (half the supply) assumed the voltage divides equally.

Mark allocation: 1 mark for using the supply current with R1; 1 mark for 10.3 V. Consequential on part b.

SAMPLE