

PRE-APPRENTICESHIP

Maths & Literacy for Electrical

Contents

Introduction v

About the author vi

Acknowledgements vi

LITERACY		
Unit 1	Spelling	1
Unit 2	Alphabetising	2
Unit 3	Comprehension	3
MATHEMATICS		
Unit 4	General Mathematics	5
Unit 5	Basic Operations Section A: Addition Section B: Subtraction Section C: Multiplication Section D: Division	10
Unit 6	Decimals Section A: Addition Section B: Subtraction Section C: Multiplication Section D: Division	16
Unit 7	Fractions Section A: Addition Section B: Subtraction Section C: Multiplication Section D: Division	22
Unit 8	Percentages	25
Unit 9	Voltage, Current and Resistance	27
Unit 10	Measurement Conversions	29

Unit 11	Measurement – Length and Area Section A: Circumference Section B: Diameter Section C: Area	30
Unit 12	Earning Wages	34
Unit 13	Squaring Numbers Section A: Introducing square numbers Section B: Applying square numbers to the trade	36
Unit 14	Ratios Section A: Introducing ratios Section B: Applying ratios to the trade	39
Unit 15	Mechanical Reasoning	42
Unit 16	Practice Written Exam for the Electrical Trade	44

Glossary 54

Formulae and data 55

Notes 58

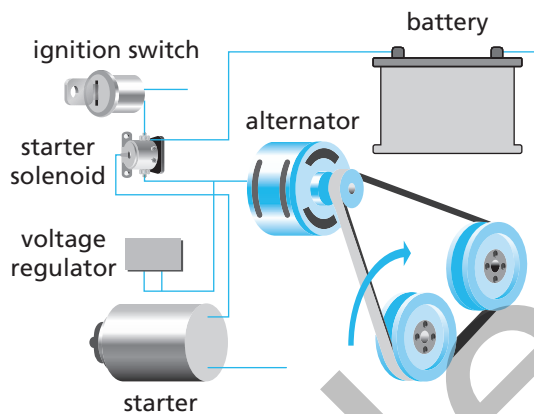
Unit 4: General Mathematics

Short-answer questions

Specific instructions to students

- This unit will help you to improve your general mathematical skills.
- Read the following questions and answer all of them in the spaces provided.
- No calculators.
- You will need to show all working.

QUESTION 1



What unit of measurement would you use to measure:

a electricity?

Answer:

b the resistance in an electrical circuit?

Answer:

c a length of conduit?

Answer:

d the weight of a ladder?

Answer:

e the speed of a broadband connection?

Answer:

f the frequency of a current?

Answer:

g the unit of electrical current?

Answer:

QUESTION 2

Write an example of the following and give an example of where it may be found in the electrical industry.

a percentages

Answer:

b decimals

Answer:

Unit 9: Voltage, Current and Resistance

Short-answer questions

Specific instructions to students

- In this unit, you will be able to practise and improve your skills in calculating voltage, current and resistance.
- Read the following questions and answer all of them in the spaces provided.
- No calculators.
- You will need to show all working.

Ohm's law: $V = I \times R$

where:

V = voltage, with volts (V) as the unit of measurement

I = current, with amperes (A) as the unit of measurement

R = resistance, with ohms (Ω) as the unit of measurement

Transposing this formula gives the following variations:

$$I = \frac{V}{R}$$

$$R = \frac{V}{I}$$

QUESTION 1

What is the voltage (V) of a small appliance if the current (I) is 12 A and the resistance (R) is 10 Ω ?

Answer:

QUESTION 2

What is the resistance (R) if the current (I) is 15 A and the voltage (V) is 240 V?

Answer:

QUESTION 3

Find the current (I) if the voltage (V) is 240 V and the resistance (R) is 20 Ω .

Answer:

QUESTION 4

Find the voltage (V) if the resistance (R) is 25 Ω and the current (I) is 5 A.

Answer:

QUESTION 5

What is the resistance (R) if the current (I) is 25 A and the voltage (V) is 240 V?

Answer:

QUESTION 6

Find the current (I) if the voltage (V) is 240 V and the resistance (R) is 50 Ω .

Answer:

Section A: Introducing ratios

Short-answer questions

Specific instructions to students

- This section is designed to help to improve your skills in calculating and simplifying ratios.
- Read the following questions and answer all of them in the spaces provided.
- No calculators.
- You will need to show all working.
- Reduce the ratios to the simplest or lowest form.

QUESTION 1

The number of teeth on gear cog 1 is 40. The number of teeth on gear cog 2 is 20. What is the ratio of gear cog 1 to gear cog 2?

Answer:

QUESTION 2

Pulley A has a diameter of 60 cm and pulley B has a diameter of 15 cm. What is the ratio of diameter A to B?

Answer:

QUESTION 3

Pulley belt A has a diameter of 48 cm and pulley belt B has a diameter of 16 cm. What is the ratio of diameters of A to B?

Answer:

QUESTION 4

Two gear cogs have 75 and 15 teeth respectively. What is the ratio?

Answer:

QUESTION 5

Three cogs have 80 : 60 : 20 teeth respectively. What is the ratio?

Answer:

QUESTION 6

A lathe has 2 pulleys that have diameters of 16 cm and 20 cm respectively. What is the lowest ratio?

Answer:

QUESTION 7

The diameter of pulley A on a band saw is 32 cm. Pulley B has a diameter of 16 cm and pulley C has a diameter of 48 cm. What is the lowest ratio of the three compared together?

Answer:

QUESTION 8

Three pulleys have different diameters: 18 cm, 16 cm and 10 cm respectively. What is the comparative ratio?

Answer:

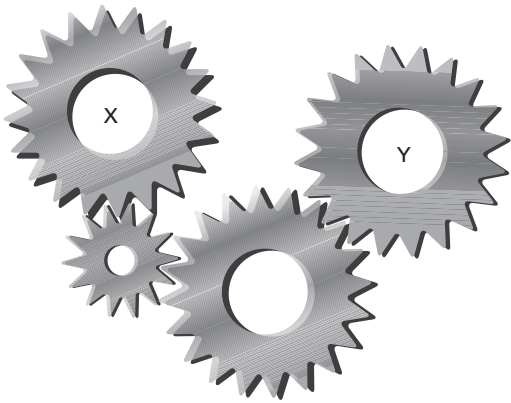
Unit 15: Mechanical Reasoning

Short-answer questions

Specific instructions to students

- This section is designed to help to improve your skills in mechanical reasoning.
- Read the following questions and answer all of them in the spaces provided.
- No calculators.
- You will need to show all working.

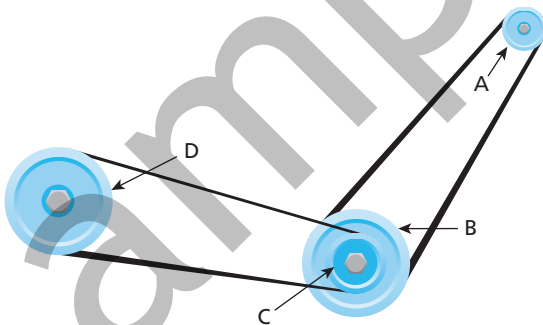
QUESTION 1



If cog X turns in a clockwise direction, which way will cog Y turn?

Answer:

QUESTION 2

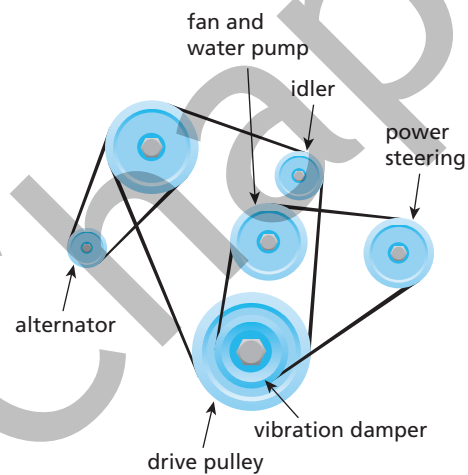


If pulley A turns in a clockwise direction, which way will pulley D turn?

Answer:

QUESTION 3

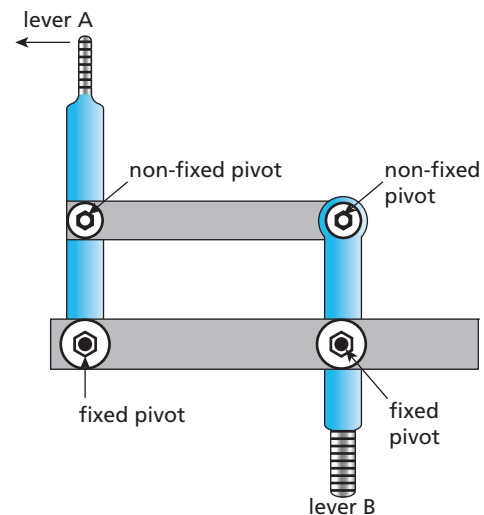
If the drive pulley in the following diagram of a work van engine turns in a clockwise direction, in which direction will the alternator turn?



Answer:

QUESTION 4

Looking at the following diagram, if lever A moves to the left, in which direction will lever B move?



Answer:

Comprehension

Short-answer questions

Specific instructions to students

- Read the following passage and then answer the questions that follow.

The VET lecturer came into class and started writing on the whiteboard immediately. It was the first lesson with this class and he wanted to introduce the students to the topics of current, voltage, power and resistance. He began with current, and explained that an electric current is the flow of electric charge. He said that the unit for measuring the sizes of electrical currents is the ampere, but everyone in the trade referred to them as 'amps'. Most of the students found this interesting, especially because of its high relevance to their chosen trade. The lecturer also pointed out that the common 8 amp or 15 amp fuses will burn out or melt if they are exposed to currents greater than these amounts.

The lecturer then moved on to the topic of voltage. He explained that electrical pressure supplied by the cell moves an electric charge through a circuit. This is known as voltage. The unit for measuring voltage is the volt. Normally, a car would use a 12 V battery and a house would use around 240 V. When the concept of power was introduced, he explained that this was the rate at which electrical appliances used electrical energy. Power is always measured in watts. He gave an example of a 60 W light bulb being brighter than a 25 W bulb. The reason for this is that a 60 W bulb uses more energy than a 25 W bulb. Some of the energy-efficient bulbs are only 8 W, and despite only using one-sixth of the power, they nevertheless give off similar brightness to a 50 W bulb.

The last topic that the lecturer introduced was resistance. He explained that the rate that electricity flows through a circuit is determined by how much resistance there is. He gave a good example of how a 60 W light bulb filament has a lower resistance than a 25 W light bulb filament. More current can then flow through the 60 W globe, thus making a brighter light. The unit that measures resistance is the ohm. The lecturer finished off by drawing some symbols and circuits that included these concepts.

QUESTION 1

1 mark

What were the four topics that the lecturer introduced?

Answer:

QUESTION 2

1 mark

In what order did he introduce the topics?

Answer:

QUESTION 3

1 mark

What is the unit of measurement for each topic?

Answer:

Section B: General Mathematics

QUESTION 1

3 marks

What unit of measurement would you use to measure:

a current?

Answer:

b resistance?

Answer:

c voltage?

Answer:

QUESTION 2

3 marks

Write an example of the following and give an instance of where it may be found in the electrical industry.

a percentages

Answer:

QUESTION 4

1 mark

What happens to fuses if they have too much current flowing through them?

Answer:

QUESTION 5

1 mark

Why is a 60 W bulb brighter than a 25 W globe? How much less power does an energy-efficient globe use?

Answer:

b decimals

Answer:

c fractions

Answer:

QUESTION 3

2 marks

Convert the following units.

a 3 W to kilowatts

Answer:

b 5 kW to watts

Answer:

QUESTION 4

2 marks

Write the following in descending order:

0.7 0.71 7.1 70.1 701.00 7.0

Answer:

QUESTION 5

2 marks

Write the decimal number that is between:

a 0.1 and 0.2

Answer:

b 1.3 and 1.4

Answer:

QUESTION 6

2 marks

Round off the following numbers to two (2) decimal places.

a 5.177

Answer:

b 12.655

Answer:

QUESTION 7

2 marks

Estimate the following by approximation.

a 101×81

Answer:

b 399×21

Answer:

QUESTION 8

2 marks

What do the following add up to?

a \$7, \$13.57 and \$163.99

Answer:

b 4, 5.73 and 229.57

Answer:

QUESTION 9

2 marks

Subtract the following.

a 196 from 813

Answer:

b 5556 from 9223

Answer:

QUESTION 10

2 marks

Use division to solve:

a $4824 \div 3$

Answer:

b $84.2 \div 0.4$

Answer:

QUESTION 11

4 marks

Using BODMAS, solve:

a $(3 \times 7) \times 4 + 9 - 5$

Answer:

b $(8 \times 12) \times 2 + 8 - 4$

Answer:

Formulae and data

Circumference of a Circle

$$C = \pi \times d$$

where: C = circumference, $\pi = 3.14$, d = diameter

Diameter of a Circle

$$\text{Diameter } (d) \text{ of a circle} = \frac{\text{circumference}}{\pi(3.14)}$$

Area

Area = length \times breadth and is given in square units

$$\text{Area} = l \times b$$

Voltage

$$\text{Voltage } (V) = \text{current } (I) \times \text{resistance } (R)$$

$$V = I \times R$$

Current

$$\text{Current } (I) = \frac{\text{voltage } (V)}{\text{resistance } (R)}$$

$$I = \frac{V}{R}$$

Resistance

$$\text{Resistance } (R) = \frac{\text{voltage } (V)}{\text{current } (I)}$$

$$R = \frac{V}{I}$$