Practice Aptitude Assessment

for

Electrical Industry

(Electrical/Electronics Apprentice)
Acknowledgements

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I am sure that over the years many thousands of students will benefit from Jerry’s dedication to the project.

Another special mention must go to Jane Harvey. Jane was the person who initially planted the seed in respect of developing an aid to assist students prepare themselves for interviews and assessments for the trade areas. Jane has been there during the planning and programming stages, to assisting with the coordination of the many other people who have assisted in some form in the development of this resource, to grouping the maths examples under appropriate headings and preparing the answers. Jane has fought with me every inch of the way, through thick and thin at times, to produce a quality product which we hope will fill a vast void that has been identified in this sector of the VET/Career education pathway of students.

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Guidance

This assessment has been developed with the assistance of Industry and Registered Training Organisations, based on the needs and requirements of the Industry sector.

Please note that rates quoted in this assessment for various items, including pay rates, are not meant to reflect today’s values, but are used purely for mathematical purposes.

This assessment is intended to prepare people who may be required to sit an aptitude test as part of an interview and assessment process for a job vacancy, such as an apprenticeship.

The assessment can be used by a number of different organisations or people such as Group Training Organisations, Career Education Teachers, Mathematics Teachers within schools, or New Apprenticeship Centres.

The assessment can be:

- provided to individual people to enable them to practice and hone their skills before sitting an actual aptitude test.
- used by Career Education Teachers for individuals or in a class setting to provide general guidance to students on what they may expect during the interview process if they intend commencing a career as an apprentice.
- used by Mathematics Teachers as a guide to Industry mathematics requirements at the entry point of a particular apprenticeship career path.

This practice aptitude assessment has two components; Mathematics and Literacy.

You may find that this assessment differs from similar tests administrated by Industry as their tests may have other elements included that other ones do not, such as:

- Mechanical Reasoning;
- Electrical Theory;
- Electrical Knowledge and reasoning;
- General Knowledge

The mathematics questions contained within this document are equivalent to Applied Mathematics at the Year 10 level in South Australia.

The assessment should be able to be completed in approximately 1 hour 45 minutes.

Calculators may be used to complete this practice assessment.
ENGLISH

Spelling

1. Put the following words into alphabetical order:
   - Electrical fitter
   - Air conditioning
   - Trainee electrician
   - Electronics consumer
   - Air compressors
   - Components
   - Electrical equipment
   - Wiring diagrams
   - Training coordinator
   - Systems Electricians

2. The following text has 10 spelling errors. Correct those errors and list them in the order you find them in the text.

   To become a Sistems Electrician usually reqires the completion of a New Aprenticeship in Electro-tecknology or Engineering - Electrical/Electronics Trade. Entry requirements may vary, but employers generally reqire Year 10 with good results in English, maths and science. The length of training can very and will involve booth on-the-job and off-the-job componants. The off-the-job training is provided though Registered Training Organisations to Certificate III level.

3. In each of the columns below, you are given three spellings of the same word. Circle the correct spelling in each case.

   (a) Controller  (b) Controller  (c) Controla
   (d) Programmable  (e) Programmible  (f) Programable
   (g) Circuit  (h) Circuit  (i) Circuit

Comprehension

This is a test of how well you understand what you read. Read the following passages below then answer the questions that follow.

Programmable Logic Controllers.

There are three common control systems in use today, and each has its advantages and disadvantages. The oldest system is the hard-wired relay system, using relays as the control and logic devices, and using insulated wires for the interconnections between the relays. The system is time-consuming to set up and fault-find, and due to the large number of contacts and interconnections, may be unreliable over a long period of time. It is easy to fault-find, however, as most relays have visible contacts, and the moving parts make it simple to observe what is happening in the circuits. It is not easily damaged by slightly elevated supply voltages, and is not affected by electrical ‘noise’ and static electricity.
The second system is the **fixed logic system**. It employs hard-wired ‘silicon chips’ to simulate the equivalent relay circuit, and it is usually built on a printed circuit board, which uses copper ‘tracks’ on the circuit board instead of wires. Its reliability is very good, as it lacks the moving contacts of the relay system, but cheap units may develop faults due to poor soldering or mishandling. The ‘silicon chip’ circuitry can easily be destroyed by relatively low voltages or static electricity, and specialised skills and equipment may be required to repair fixed logic systems. Often, a fixed logic system printed circuit board is treated as an unrepairable module, and may be replaced (at significant expense) rather than being repaired due to this difficulty in repairing it. It may be sensitive to elevated supply voltages, may respond to electrical ‘noise’ and can be destroyed by static electricity.

The third system is the **Programmable Logic Controller**. The Programmable Logic Controller (PLC) is a simple computer that can accept inputs from electrical control devices such as thermostats, pressure switches, relays, and other contacts. It can also drive electrical outputs such as lamps, relays, solenoids, contactors etc. These devices are often referred to as ‘Programmable Controllers’. The computer is built on a printed circuit board, like the fixed logic systems. Early models performed only logic functions, so the name ‘Programmable Logic Controller’ was appropriate. Recent models are capable of complex, non-logic functions, and some manufacturers have reflected this ability by dropping the ‘Logic’ reference. As the abbreviation for ‘Programmable Controller’ became ‘PC’, there was often confusion between these devices and the Personal Computer. Hence, although the PLC is capable of far more than simple ‘logic’ operations, the abbreviation usually retains the ‘L’ reference to differentiate the PLC from the IBM-type PC.

Although the initial cost of a PLC system may be higher than other systems, PLCs are appearing in many applications these days because of their advantages over other systems. These include:
- their flexibility in being reprogrammable to do different tasks;
- their reliability due to their lack of moving parts and contacts;
- the ease with which they can be programmed;
- their simplicity of design and installation. Like fixed logic systems, PLCs may also be sensitive to elevated supply voltages, may respond to electrical ‘noise’ and can be destroyed by static electricity.

Now read each of the following questions and possible answers given below, and from the previous description, indicate what you think the suitable answer or answers might be for each of the questions below. Note that there may be **more than one** suitable answer to some questions.

4. Which of the 3 systems described above is the oldest one?
   (a) Hard-wired Relay System, (b) Fixed Logic System
   (c) Programmable Logic Controller

5. Which of the above systems may develop problems due to poor soldering?
   (a) Hard-wired Relay System, (b) Fixed Logic System
   (c) Programmable Logic Controller
6. Which of the above systems may respond to electrical noise?
   (a) Hard-wired Relay System, (b) Fixed Logic System
   (c) Programmable Logic Controller

7. Which of the systems allows the operator to watch things happening in it?
   (a) Hard-wired Relay System, (b) Fixed Logic System
   (c) Programmable Logic Controller

8. How are PLCs affected by static electricity?
   (a) It has no affect on them. (b) They may respond to it normally, (c) They may be destroyed by it.

9. Why are fixed logic systems often thrown away, rather than being repaired, if faulty?
   (a) It is usually cheaper to replace them than repair them.
   (b) It is often difficult to solder their components in reliably.
   (c) They usually require special skills and equipment to work on them.

10. Why was the letter 'L' initially dropped from the 'PLC' abbreviation?
    (a) PLcs started using non-Logic functions in their operations.
    (b) PLCs stopped using Logic functions in their operation.
    (c) PLCs were being confused with the IBM PC.

11. Why was the letter 'L' re-inserted in the 'PLC' abbreviation?
    (a) PLCs stopped using non-Logic functions in their operations.
    (b) PLCs started using Logic functions in their operation.
    (c) PLCs were being confused with the IBM PC.

12. What is the main advantage of good quality fixed logic systems over relay systems?
    (a) They are less sensitive to voltage surges.
    (b) They are more reliable. (c) They are easier to fault-find.

13. Which of the following is not an advantage of a PLC system over a relay system?
    (a) Its long-term reliability. (b) Its lower overall cost.
    (c) Its flexibility in being re-programmable. (d) Its ease of installation.

14. Which of the following may be used as an electrical output for a PLC system?
    (a) A relay, (b) A thermostat, (c) A lamp, (d) A switch
    (e) A solenoid, (f) A 'silicon chip'

15. Which of the following may be used as an electrical input for a PLC system?
    (a) A lamp, (b) A solenoid, (c) A relay, (d) A 'silicon chip'
    (e) A thermostat, (f) A switch
Mathematics

Numbers (Scientific Notation, Rounding, Estimating)

1. From the list of numbers below, select the one which is a:
   a) percentage
   b) decimal number
   c) fraction
   d) mixed number
   e) ratio
   f) angle

<table>
<thead>
<tr>
<th>3/8</th>
<th>35°</th>
<th>75%</th>
</tr>
</thead>
<tbody>
<tr>
<td>5:4</td>
<td>16·37</td>
<td>3¼</td>
</tr>
</tbody>
</table>

2. Round
   (a) 35 · 6754 to two decimal places
   (b) 425 · 8 to the nearest tens
   (c) 248 to the nearest hundreds

3. Arrange in ascending order (from smallest to largest):

   4, -2, ½, 3·7, 0, -8

4. Write in descending order:

   ¼, ⅓, 0·3

5. Which one of the following represents the number 27 000 000 000 in scientific notation:

   A 27 x 10^{10}
   B 2·7 x 10^{10}
   C 2·7 x 10^{-10}
   D 27 x 10^{10}

6. Select the best estimate for:
   (a) 4249 x 71
   (b) 80000÷38

   280000, 150000, 28000, 200, 2000, 20000, 4000

7. Evaluate the following:
   (a) 10^2
   (b) 3³
   (c) √36
   (d) (√9)^2

   Arithmetic (Addition, Subtraction, Multiplication, Division)

8. Find the total of:
   (a) $2, $21·45 and $8·23
   (b) 18·32, 471·019 and 315
9. Solve:
   (a) 5,218 – 1,784
   (b) 43.18 – 29.461

10. Multiply:
   (a) 6.87 by 10
   (b) 13.8 by 3
   (c) 46.2 by 8.5

11. Divide:
   (a) 3.45 by 10
   (b) 3024 by 14
   (c) 56.2 by 0.2

12. Simplify:
   (a) \( \frac{2+3 \times 4}{4-10+2} \)
   (b) \( \frac{50 + 50}{2 \times 25} \)
   (c) \( (16-5) \times 3 \)
   (d) \( (2 + 3) \times 4 \)

13. Multiply the following:
   (a) \( 3 \cdot 485 \times 10^{-2} \)
   (b) \( 16 \cdot 919 \times 10^{2} \)

Fractions

14. Which fraction is between \( \frac{1}{4} \) and \( \frac{3}{4} \)?

|   | \( \frac{1}{4} \) | \( \frac{1}{2} \) | \( \frac{3}{4} \) | 3\( \frac{1}{4} \) |

15. Add the following:
   (a) \( \frac{1}{4} \) and \( \frac{1}{2} \)
   (b) \( \frac{2}{9} \) and \( \frac{5}{6} \)
   (c) \( 3\frac{1}{4} \) and \( \frac{1}{8} \)

16. Subtract the following:
   (a) \( \frac{5}{6} - \frac{1}{4} \)
   (b) \( 2 \frac{1}{4} - \frac{3}{7} \)

17. Express as a fraction in lowest terms:
   (a) 0.75
   (b) 2.6
   (c) 30%

Percentages

18. Evaluate the following:
   (a) 10% of $44
   (b) 25% of $12.84

19. Michelle earns $500 a week as an apprentice electrician. She gets a pay rise of 5%. What is her new wage?
20. An article bought for $250 is sold for $375. Find:
   (a) the profit in dollars
   (b) the profit as a percentage of the cost price.

21. Jonathan the painter buys the following from a paint store:
    paint $215; rollers and brushes $95; cleaning fluids $12; and
    plastic covers $8. Jonathan gets 10% trade discount.
   (a) How much would he pay with no discount?
   (b) How much would he pay with discount?
   (c) How much has he saved?

22. Barry scored 80% in a TAFE exam. There were 25 questions.
   (a) How many questions did Barry get right?
   (b) How many questions did Barry get wrong?

23. What percentage is 30 out of 50?

24. Electrical goods are subject to a goods and services tax (GST)
    of 10% of the sale price. If a refrigerator’s pre-tax price is
    $850
   (a) what is the tax
   (b) selling price

25. The efficiency of a machine is rated at 70%. If the input to the
    machine is 200 watts, what is the output power available?

Decimals

26. Find the decimal number halfway between:
   (a) 0.6 and 0.8
   (b) 2.8 and 2.9

27. Write the following decimals in descending order.

| 7.19 | 71.9 | 0.719 |

28. Select the correct answer to 18.642 ÷ 0.02:
   A 9321  B 93.21  C 9321  D 932.1

Algebra

29. Remove the brackets and simplify the following:
   (a) (2x+y) - (x-4y)
   (b) (3a-b) - (2a-3b)

30. If P=F/A find P if F=60 and A=20?

31. Re-arrange the following formulae to make the letter in
    brackets the subject of the formula:
   (a) P=VI (V)
   (b) P= \( \pi Q \frac{n}{30} \) (Q)

32. The formula for working out the voltage is V=E-iR.
    Re-arrange the formula to:
   (a) make E the subject
   (b) make R the subject.
33. Divide $24 into the ratio 3:1.

34. What is the ratio of the number of circles to squares?

35. The mass of two resistor boxes are in the ratio of 2:5. The smaller box has a mass of 20kg. What is the mass of the larger box?

36. Convert 5 amps to milliamps.

37. Convert 12k Ohms to Ohms.

38. A large washer has an outer radius of 10mm and a hole with a diameter of 14mm. What is the area of the top surface of the washer?

39. Calculate the area of the triangle which has a base length of 10 cm and a height of 8 cm.

40. What is the average of 12 and 18?

41. An electric car is travelling at 60km/hr, how far will it travel in 3 hours?

42. Two numbers add up to 40. Find the other number if one of the numbers is 15?

43. Mary, a data-cabling technician, receives a salary of $32,500 a year. How much does she receive each fortnight?
ANSWERS

ENGLISH

1. Air compressors, Air conditioning, Components, Electrical equipment, Electrical fitter, Electronics consumer, Systems Electricians, Trainee electrician, Training coordinator, Wiring diagrams

2. Systems, requires, Apprenticeship, Electro-technology, Engineering, require, vary, both, components, through.

3. b) d) h)

4. a) 5. b) 6. b) & c) 7. a) 8. c) 9. c)

5. a) 75%, b) 16.37, c) 3/8, d) 3/4, e) 5/4, f) 35°

6. -8, -2, 0, 1/2, 3/7, 4

7. B

8. a) 3568, b) 430, c) 200

9. a) 3434, b) 13·719

10. a) 345, b) 216, c) 281

11. a) 03485, b) 1691·9

12. a) ½, b) 11/18, c) 3/8

13. a) ½, b) 23/5, c) 3/10

14. $525

15. a) 3/5, b) 0·3, ½

16. a) 7/12, b) 1½

17. a) $330, b) $297, c) $33

18. a) 20, b) 5

19. 60%

20. a) $125, b) 50%

21. 140 watts

22. $85, b) $935

23. 719, 7·19, 0·719

24. 3:2

25. a) x + 5y, b) a + 2b

26. a) 0·7, b) 2·85

27. 30. 3

28. a) V = P/I, b) Q = 30P/πn

29. 32. a) E = V + i R, b) R = E - V

30. $18, $6

31. 50kg

32. 12,000 Ω (Ohms)

33. 40cm²

34. 160mm²

35. 180km

36. 5000 mA

37. $1250·00

38. 15