NCFE

NCFE Level 1/2 Technical Award in Engineering (603/2963/4)

Unit 01 Understanding the Engineering World

Paper number: **Past Paper**
Assessment date: **Tuesday 28 June 2022**

Time allowed: **1 hour 30 minutes**
Time: **9.00am – 10.30am**

Learner instructions
- Use black or blue ink.
- Answer **all** questions.
- Read each question carefully.
- You **must** write your responses in the spaces provided.
- You may do rough work in this answer book. Cross through any work you do not wish to be marked.
- If you use a supplementary answer booklet, you must add your learner name, learner number and centre number to the front cover of the booklet. Insert your supplementary answer booklet inside this question paper at the end of your test.
- All of the work you submit **must** be your own.

Learner information
- The marks available for each question are shown in brackets.
- The maximum mark for this paper is 80.
- You may use a calculator.

Do not turn over until the invigilator tells you to do so.

Please complete / check your details below

Learner Name:

Centre Name:

Learner Number:

Centre Number:

You have been provided with the list of equations below.
These equations can be used during the assessment.

Equations for properties

Energy

Efficiency   efficiency (%) = (useful energy out ÷ total energy in) x 100

Power   power = energy ÷ time
                    $P = E ÷ t$

Work done   work done = force x distance
                    $W = F \times d$

Forces and Motion

Speed   speed = distance ÷ time
                    $s = d ÷ t$

Acceleration   acceleration = change in velocity ÷ time
                    $a = (v-u) ÷ t$

Force   force = mass x acceleration
                    $F = m \times a$

Moment of force   moment = force x perpendicular distance from pivot
                    $m = F \times d$

Weight   weight = mass x gravity
                    $w = m \times g$

Momentum   momentum = mass x velocity
                    $p = m \times v$

Density   density = mass ÷ volume
                    $d = m ÷ v$

Pressure   pressure = force ÷ area
                    $p = F ÷ A$

Electricity

Power   power = voltage x current
                    $P = V \times I$

Voltage   voltage = current x resistance
                    $V = I \times R$

Current   current = power ÷ voltage
                    $I = P ÷ V$

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| Resistance | resistance = voltage ÷ current |
| | $R = V \div I$ |

Geometric

Area

Square	length of side²
Rectangle	length of side 1 x length of side 2
Triangle	(length of base x height of triangle) ÷ 2
Circle	π x radius²

Volume

Cube	length of side³
Pyramid	(1/3) x (base area) x height of pyramid
Cylinder	π x radius² x height of cylinder

Please turn over for the first question.

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Answer **all** questions in the spaces provided.

Total available marks: **80**

1   **Figure 1** shows a mechanical system.
                              Figure 1

Identify the mechanical system shown in **Figure 1**.

[1 mark]

A   Fibre optics

B   Hydraulics

C   Pulleys

D   Gears

Answer _____

2   Which engineering discipline includes radiotherapy?

[1 mark]

A   Biomedical

B   Civil

C   Electronic

D   Chemical

Answer _____

3 The Health and Safety at Work Act (HASAWA) makes employers responsible for their employees' safety.

Identify **one other** group of people that the HASAWA makes employers responsible for.

[1 mark]

_____

_____

4 (a) Which **one** of the following activities should an employee wear a bump cap for?

[1 mark]

A   Using a laser cutter

B   Using an angle grinder

C   Working in a confined space

D   Working on a construction site

Answer _____

4 (b) It is important to choose the most appropriate personal protective equipment (PPE) for each job.

Give **two** reasons for choosing disposable overalls.

[2 marks]

_____

_____

_____

4 (c) Welding is hazardous for a welder.

State **two** types of PPE that would protect the hands and arms of a welder.

Justify why **each** type of PPE should be worn.

[4 marks]

PPE1: _____

Justification: _____

_____

PPE 2: _____

Justification: _____

_____

5 (a) Which **one** of the following does a milliamp measure?

[1 mark]

A   Circuits

B   Current

C   Time

D   Volts

Answer _____

5 (b) Which **one** of the following is equivalent to 1 kiloamp?

[1 mark]

A   1 amp

B   10 amps

C   100 amps

D   1000 amps

Answer _____

5 (c) Which **one** of the following does is equal to 1 000 000 microcandelas?

[1 mark]

A   1 millicandela

B   100 millicandelas

C   1 candela

D   10 candelas

Answer _____

5 (d) Which **one** of the following does a kilogram measure?

[1 mark]

A   Area

B   Density
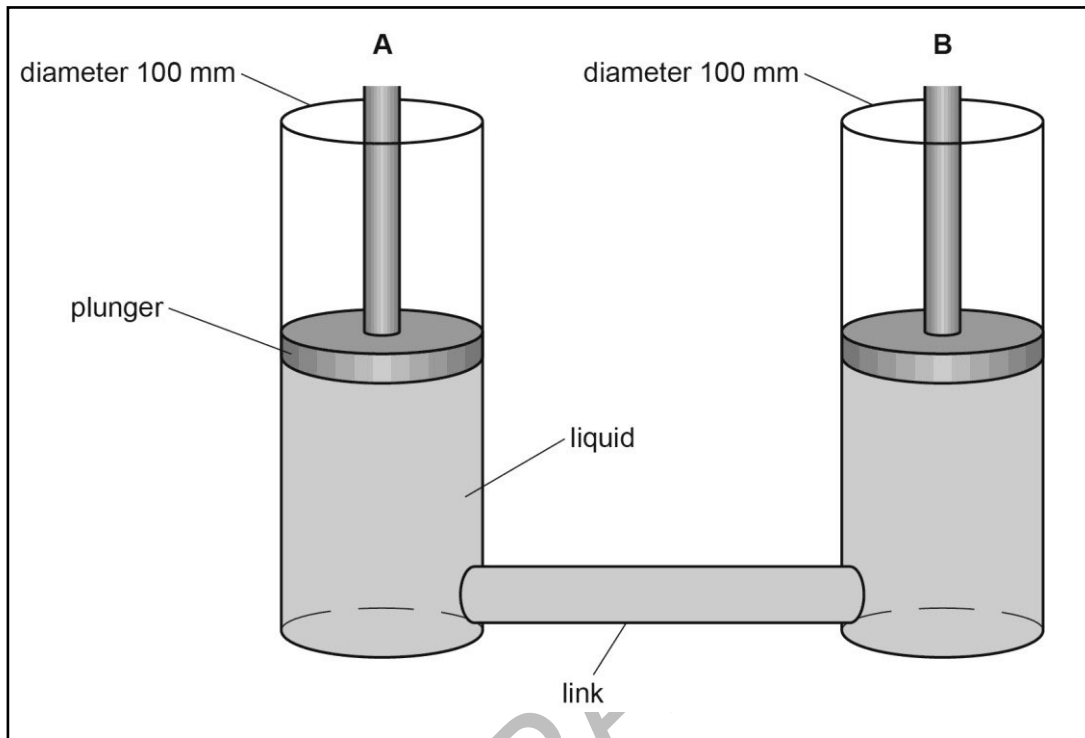
C   Mass

D   Volume

Answer _____

Please turn over for the next question.

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6 **Figure 2** shows Pascal's principle of a liquid in a closed container. Each cylinder is 100 mm in diameter.

Figure 2

Describe what would happen if a downward pressure is applied to the plunger at point **A** in **Figure 2**.
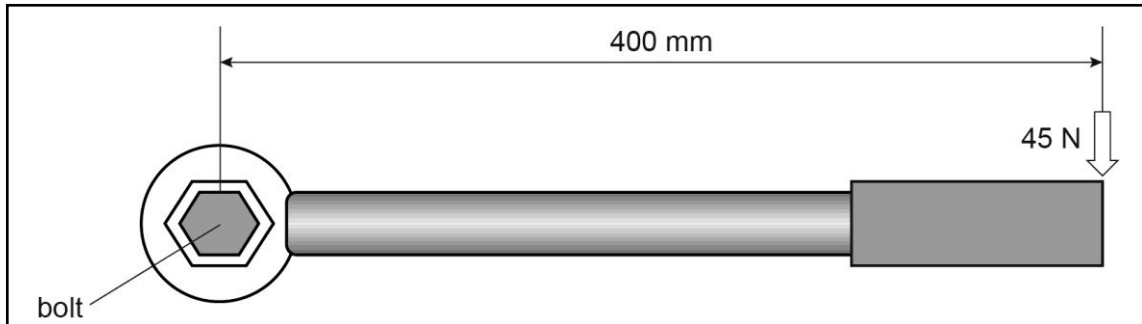
[2 marks]

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7 (a) An engineer is tightening a bolt on the front wheel of an electric motorcycle. The engineer applies 45 N of force at a distance of 400 mm from the bolt.

Figure 3 shows the spanner tightening the bolt.

Figure 3

Calculate the moment of force being applied on the bolt in **Figure 3**.

Use the equations on pages 2 and 3.

Show your working.

[2 marks]

7 (b) Engineers are testing the motorcycle. It produces 372 W of usable power for every 400 W of input during the charging process.

Calculate the motorcycle's efficiency.

Use the equations on pages 2 and 3.

Show your working.

[2 marks]

_____

_____

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_____

7 (c) The motorcycle and rider require a force of 350 N to move.

Calculate the work done to move them 0.6 km.

Use the equations on pages 2 and 3.

Show your working.

[2 marks]

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8 Electricity and magnetism are often combined in everyday products, such as a washing machine or a vehicle.

Evaluate the importance of magnetism in everyday products.

[9 marks]

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Please turn over for the next question.

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9 An electrical wire can become hot when a current is passed through it.

Give **one** reason why the wire might become hot **and** identify **one** risk if the wire heats up.

[2 marks]

Reason: _____

_____

Risk: _____

_____

10 (a) It is important that engineering components can withstand regular use over a long period of time.

Which **one** of the following properties identifies this characteristic?

[1 mark]

A Brittleness

B Durability

C Plasticity

D Toxicity

Answer _____

10 (b) Which **one** of the following statements describes the ductility of a material?

[1 mark]

A The ability to be drawn, reducing its cross-section

B The ability to resist scratching, wear and indentation

C The ability to retain its original size when a force is applied

D The ability to withstand shock or impact without breaking

Answer _____

Please turn over

10 (c)   Which **one** of the following properties identifies a metal's ability to be shaped by hammering or pressing without fracture?

[1 mark]

    A   Elasticity

    B   Malleability

    C   Strength

    D   Toughness

    Answer   _____

11   Identify **two** properties of a brick that make it suitable for civil engineering applications.

[2 marks]

1: _____

2: _____
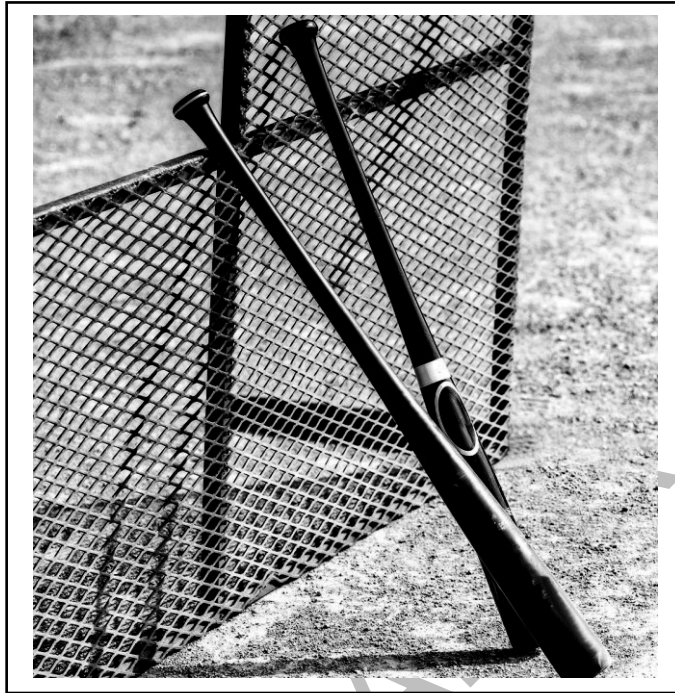
Please turn over for the next question.

Figure 4 shows carbon fibre baseball bats.

Figure 4

Carbon fibre reinforced polymer (CFRP) is now commonly used in sporting equipment such as baseball bats.

Discuss the advantages **and** disadvantages of using composite materials such as CFRP in sporting equipment.

[9 marks]

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Please turn over for the next question.

13 (a) Name **two** tools used when marking out a rectangle on sheet steel **and** justify why **each** tool is used.

[4 marks]

Tool 1: _____

Justification: _____

_____

Tool 2: _____

Justification: _____

_____

13 (b) An engineer cuts four rectangles from a 2 mm thick mild steel sheet. Each rectangle measures 95 mm by 75 mm.

Identify **two different** tools the engineer could use to cut out the rectangles.

Briefly justify which of these tools would be the most suitable for this task.

[3 marks]

Tool 1: _____

Tool 2: _____

Justification: _____

_____

Please turn over for the next question.

17

14 (a) **Figure 5** shows a Torx screwdriver.

Figure 5

Explain **one** benefit of using the Torx screwdriver shown in **Figure 5**.

[2 marks]

_____

_____

_____

_____

Please turn over for the next question.

14 (b) Figure 6 shows a nail gun.

Figure 6

Explain what PPE should be worn when using the nail gun shown in **Figure 6**.

[2 marks]

_____

_____

_____

_____

15 (a) Complete **Table 1** below by identifying the **two** ceramics that are described.

[2 marks]

Table 1

Name of ceramic	Description
	Very hard, brittle and used on tool tips for improved cutting.
	Fired clay, often used in decorative or functional containers.

19

Please turn over

15 (b) Complete **Table 2** below by identifying the **two** mechanical properties that are described.

Table 2

Name of property	Description
	Ability of a material to return to its original shape and size after force is no longer applied.
	Ability of a material to be easily shaped or moulded

16 What is the name of the regulation relating to hazardous lifting tasks?

State **two** of the three rules for reducing risk when moving a heavy item.

[3 marks]

Regulation: _____

Rule 1: _____

_____

Rule 2: _____

_____

Please turn over for the next question.

17   **Figure 7** shows a technical drawing of a component.

Figure 7
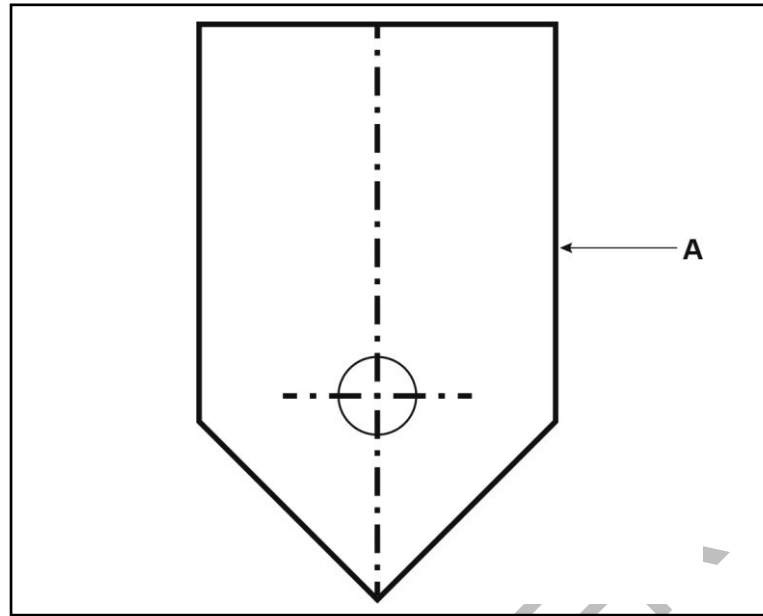
Identify the type of line shown as **A** in **Figure 7**.

[1 mark]

_____

18   Name the engineering discipline responsible for computer programming.

[1 mark]

_____

19   The Control of Substances Hazardous to Health Regulations (COSHH) protect the safety of employees.

State **two** types of hazardous substance that the COSHH Regulations cover.
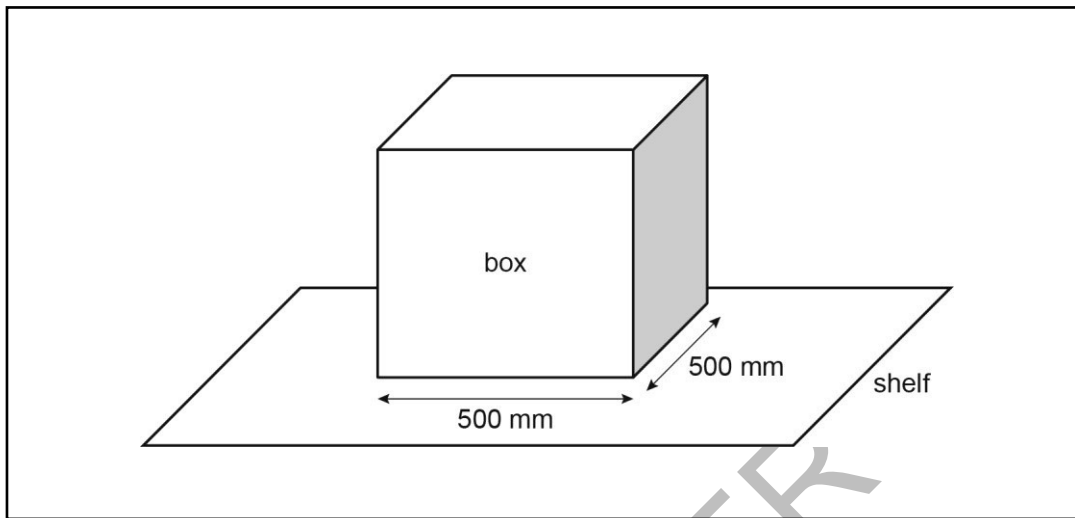
[2 marks]

1: _____

2: _____

20 **Figure 8** shows a box with a base measuring 500 mm by 500 mm on a shelf. The box applies a force of 175 N over its base.

Figure 8

Calculate the pressure applied to the shelf shown in **Figure 8**.

Use the equations on pages 2 and 3.

Show your working.

[2 marks]

_____

_____

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21 Discuss the importance of training for all new employees in an engineering factory.

[9 marks]

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