

Engineering 2019 v1.1

Unit 1 sample assessment instrument

April 2018

Examination

This sample has been compiled by the QCAA to assist and support teachers in planning and developing assessment instruments for individual school settings.

Schools develop internal assessments for each senior subject, based on the learning described in Units and 2 of the subject syllabus. Each unit objective must be assessed at least once.

Assessment objectives

This assessment instrument is used to determine student achievement in the following objectives:

1. recognise and describe mechanical and structural problems, engineering technology knowledge, and mechanics and materials science concepts and principles in relation to engineering fundamentals and society
2. symbolise and explain ideas and solutions in relation to engineering fundamentals and society
3. analyse mechanical and structural problems, and information in relation to engineering fundamentals and society
5. synthesise information and ideas to predict possible mechanical and structural solutions

Note: Objectives 4, 6, 7 and 8 are not assessed in this instrument.

Subject	Engineering		
Technique	Examination		
Unit	Unit 1: Engineering fundamentals and society		
Topics	1, 2, 3, 4 and 5		
Conditions			
Response type	Short response		
Time	2 hours	Perusal	10 minutes
Other	<ul style="list-style-type: none"> • only the QCAA formula sheet must be provided • notes are not permitted • non-programmable scientific calculator only permitted • protractor and ruler required 		
Instructions			
<ul style="list-style-type: none"> • Answer all questions in Section 1 and Section 2 on the paper in the spaces provided for each item. • For multiple-choice questions, circle the letter next to your choice of correct response. If you wish to change your answer, cross out your initial choice and circle the letter next to your new answer. • Word length for short-paragraph response items is 100–150 words per item. • Some items may require other types of responses including calculations, sketching, drawing, graphs, tables and diagrams • Section 2: Show all working for questions requiring calculations. 			
Feedback			

Section 1 — Multiple-choice, single word items

Question 1

The problem-solving process in Engineering involves four iterative phases. Which phase is considered as central to the process?

- (A) Exploring
- (B) Generating
- (C) Developing
- (D) Evaluating and refining

Question 2

The three-age system is a common way to represent the progress of human civilisation. The materials used in the three-age system are

- (A) stone, gold, iron.
- (B) iron, copper, gold.
- (C) stone, iron, bronze.
- (D) bronze, copper, iron.

Question 3

The field of engineering responsible for the analysis and design of dams is

- (A) structural engineering.
- (B) geotechnical engineering.
- (C) environmental engineering.
- (D) water resource engineering.

Question 4

Being honest and trustworthy is part of which section of Engineers Australia's *Code of Ethics*?

- (A) Exercise leadership
- (B) Demonstrate integrity
- (C) Practise competently
- (D) Promote sustainability

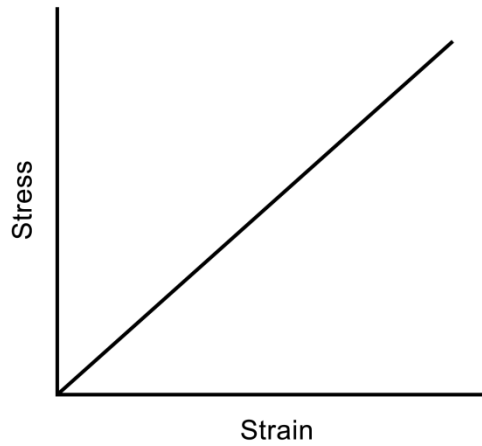
Question 5

Which one of the following is a thermal property of materials?

- (A) Ductility
- (B) Composition
- (C) Conductivity
- (D) Galvanic action

Question 6

The following stress–strain graph is generated when a material is subjected to a tensile test until failure.



What material would generate this graph?

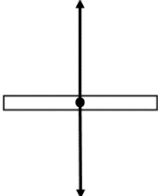
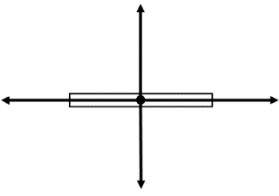
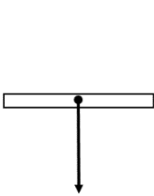
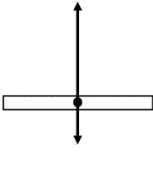
- (A) Brass
- (B) Mild steel
- (C) Stainless steel
- (D) Tungsten carbide

Question 7



helloolly 2014,
pixabay.com/en/iphone-
smartphone-desk-mobile-
518101/

Which force diagram best represents the forces acting on the mobile phone sitting on the desk in the picture above?

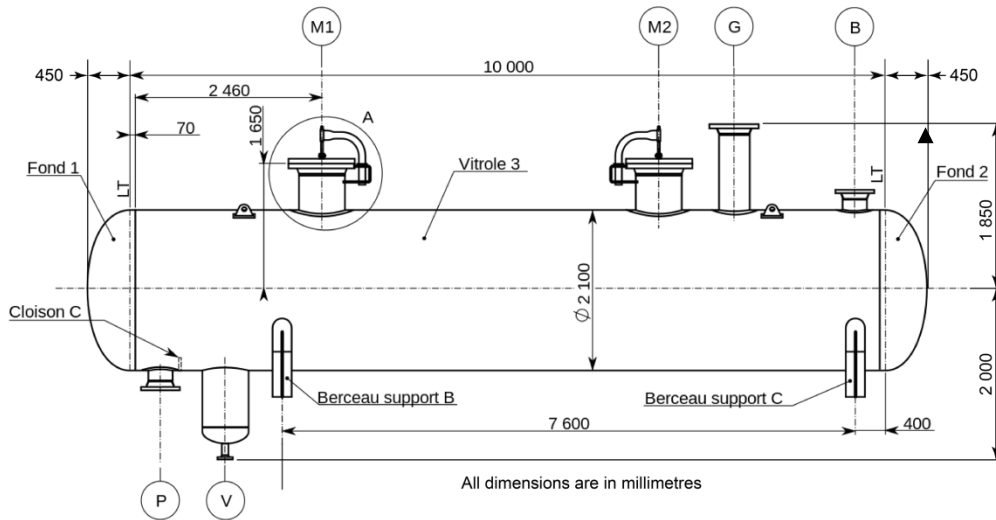
- (A) 
- (B) 
- (C) 
- (D) 

Question 8

A piece of PVC plumbing pipe displaces 60 mL when placed into a container of water. If the pipe has a mass of 78 g, what is the approximate density of PVC?

- (A) 1.3 kg/m³
- (B) 130 kg/m³
- (C) 1300 kg/m³
- (D) 13 000 kg/m³

Question 9



Éducation nationale française 2010, Assembly drawing of a reflux drum, commons.wikimedia.org/wiki/File:Ballon_de_reflux_ensemble.svg

Which of the following is a common metric scale used to represent the pressure tank above on A3 paper (297 mm x 420 mm)?

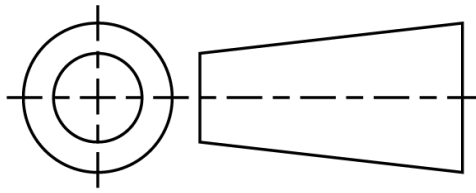
- (A) 1:30
- (B) 1:50
- (C) 30:1
- (D) 50:1

Question 10

The drawing standard AS1100.201 most accurately refers to

- (A) drawing standards used in engineering.
- (B) Australian Schools' standard for drawing.
- (C) drawing standards used in mechanical drawing.
- (D) drawing standards used in architectural drawing.

Question 11



In orthographic drawing, the symbol above represents angle projection.

Question 12

A quantity represented by the unit watt is.....

Question 13

A quantity represented by the unit joules is

Question 14

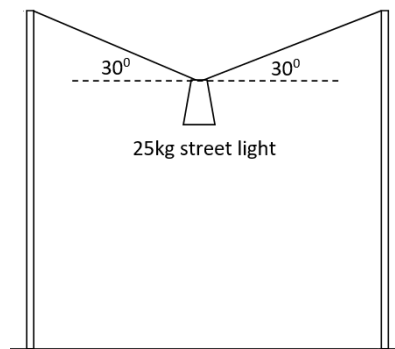
List the three equations used to represent the conditions of static equilibrium in engineering mechanics.

1.
2.
3.

Section 2 on next page.

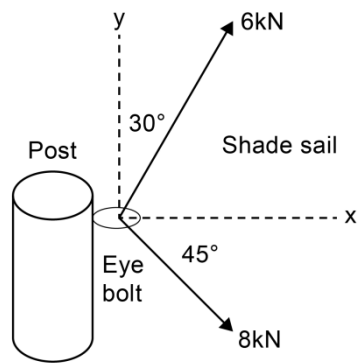
Question 2

A street light is suspended from a steel cable mounted on two street posts. The mass of the light causes the cable to sag. Calculate the tension in each side of the cable.



Question 3

A shade sail has been erected over a children's playground. The M16 eye bolt that holds the corner of the shade sail has a rated capacity of 1810 kg.



Lyle Radford 2012, Mt Gravatt Outlook, commons.wikimedia.org/wiki/File:Mt_Gravatt_Outlook_playground_(6980501858).jpg

(a) Calculate the resultant force acting on the eye bolt using the information provided in the force diagram above.

(b) Is the eye bolt strong enough to resist the applied load of the shade sail? Explain your reasoning.

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Question 4

(a) Analyse the engineering communication techniques of sketching and CAD in specific communication situations.

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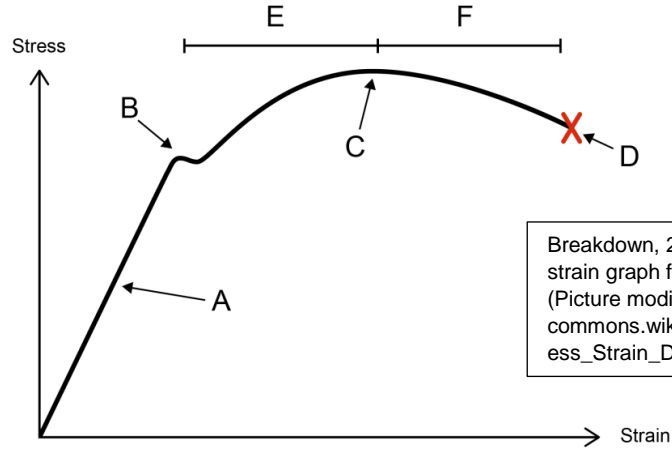
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(b) Identify one advantage and disadvantage of the use of each communication technique.

Technique	Advantage	Disadvantage
CAD		
Sketching		

Question 5



Breakdown, 2008. Typical stress vs. strain graph for a ductile material (Picture modified), CC BY-SA 3.0. commons.wikimedia.org/wiki/File:Stress_Strain_Ductile_Material.png

The graph above represents the typical stress–strain curve generated when a ductile material is tested under an applied axial tensile load.

(a) The area on the curve labelled A represents a specific property of the material tested. What is the property?

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(b) Provide an example of a material and a use that relies on this property.

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(c) Explain why this property would be important when considering the engineering uses for a material.

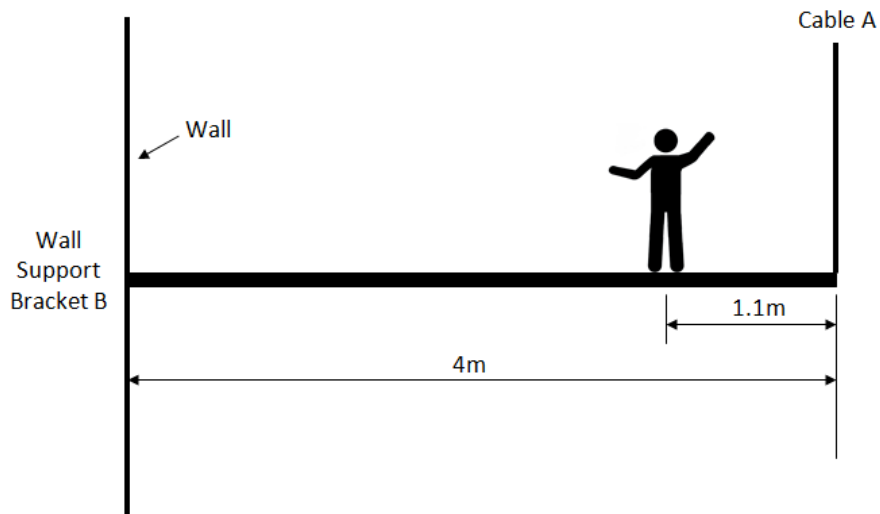
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(d) Name the significant features of the stress–strain graph represented by the letters B to F.

- B.....
- C.....
- D.....
- E.....
- F.....

Question 6

The diagram below shows a worker with a mass of 82 kg standing on a platform that has a mass of 33 kg. The platform is supported by cable A and wall support bracket B.

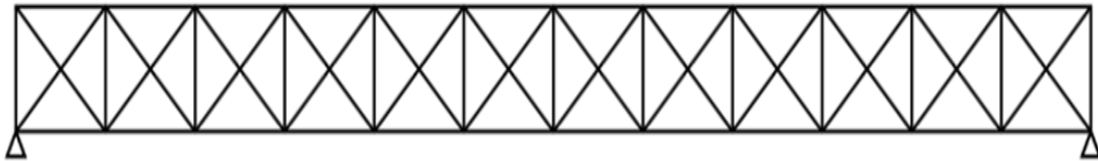


(a) Draw the force diagram that represents the diagram above.

(b) Calculate the tension in cable A and the reaction at the wall support bracket B.

Question 7

In real-world truss structures, redundant members are those that are not necessary for structural stability in the transfer of forces to the supports. The long truss represented by the diagram below includes redundant members.



Johannes Rössel 2008, Long truss drawing, commons.wikimedia.org/wiki/File:Long_truss.svg

(a) Label **four examples** of redundant members on the diagram above using an **R** →

(b) Provide an example of a real-world truss structure that includes redundant members.

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(c) Analyse the reason/s why engineers would include redundant members in the truss design.

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Question 8

An object experiences a 450 N force acting E30°S.

(a) Draw this force and determine the horizontal and vertical components graphically.

(b) Calculate the value of the horizontal and vertical components of the force.

Question 9

An applied force of 78 kN is acting horizontally to the left. Using a scale of 1 mm : 1 kN, draw this force.

Question 10



A force F balances a 6 m long, 100 kg uniform beam at A , as shown in the diagram above. The beam will be shortened in length by 2.5 m at B . Determine the new position of support A that balances the shortened beam.

