



UNIVERSITY OF JOHANNESBURG
FACULTY OF EDUCATION
NOVEMBER EXAMINATION 2014

PROGRAMME: B Ed (Hons) TECHNOLOGY EDUCATION

MODULE: THE KNOWLEDGE OF TECHNOLOGY

CODE: TKT0017

TIME: 3 hours

MARKS: 200

EXAMINERS: Prof PJ Ankiewicz
 Mr W Engelbrecht

MODERATOR: Dr W Rauscher (UP)

(This paper consists of 5 pages)

INSTRUCTIONS

Read the following instructions carefully before answering the questions:

1. Answer **ALL** the questions.
2. Read the questions carefully and answer all the questions as specifically as possible. Do not give vague and general answers.
3. You can answer the questions in Afrikaans or English.
4. Answer questions 1 to 3 in Examination book 1 and questions 4 to 7 in Examination book 2.

Answer questions 1 to 3 in Examination book 1

QUESTION 1

- 1.1 Any person who is involved in designing and making products needs to have a sound knowledge of materials. Discuss the factors that will affect your choice when selecting a material for a particular product. (10)
- 1.2 Write the names of the materials listed below in your examination book and state one use of each as well as one specific property that makes the material suitable for the use mentioned.
 - 1.2.1 Medium carbon steel
 - 1.2.2 Brass
 - 1.2.3 High density polyethylene
 - 1.2.4 Expanded polystyrene
 - 1.2.5 Silica carbide (ceramics)
 - 1.2.6 Glass reinforced polymer (fibre glass) (12)

- 1.3 Product manufacturers use a wide range of processing techniques to convert materials into products. Briefly describe the process you will use to manufacture the following products:

- 1.3.1 Engine connecting rod by using medium carbon steel
- 1.3.2 Washing machine pulley by using aluminum alloy
- 1.3.3 Electrical conduit by using P.VC.
- 1.3.4 Glass bottles by using container glass (12)

- 1.4 Why is it necessary for the bottom of a cooking pot to be a good conductor of heat? (2)

- 1.5 Many modern car bumpers are made from plastic. Why is it necessary to choose a very tough material? (2)
(38)

QUESTION 2

- 2.1 Figure 2.1 shows a frame structure which is non-rigid. Copy figure 2.1 into your examination book and change it to show how it could become rigid. (3)

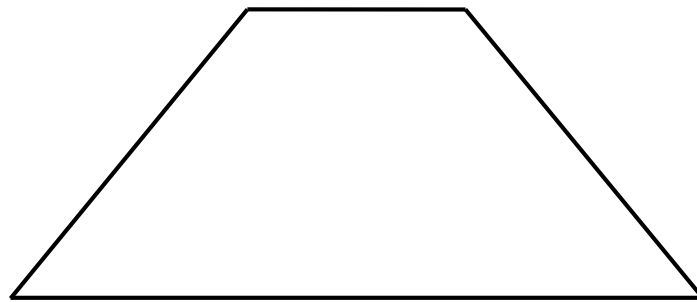


Fig. 2.1

- 2.2 Explain the important role that a structure's center of gravity plays in structural stability. (4)
- 2.3 Many large modern buildings consist of a framework of concrete beams and columns.
- 2.3.1 Which forces act mainly on columns? (2)
 - 2.3.2 Show by means of a labelled sketch what influence forces have on a beam under load. Your sketch must show where these forces occur. (4)
 - 2.3.3 Briefly explain why it is necessary to reinforce concrete beams like lintels with steel. (2)
 - 2.3.4 Draw a free hand sketch of a concrete lintel and indicate where the steel reinforcing will be placed. (2)
- 2.4 A beam's ability to resist bending depends on the material from which it is made as well as the sectional profile of the beam. Which one of the following timber beams will be the stiffest? Show the necessary calculations.

2.4.1 A beam with a length of 200cm, a breadth of 150cm and a depth of 4cm.

2.4.2 A beam with a length of 200cm, a breadth of 4cm and a depth of 100cm.
(5)

- 2.5 Figure 2.5 shows a beam with two known forces and a pivot point in the centre of the beam. Calculate the force needed at **B** to balance the beam. Use the following formula to guide your calculation:
moment = force x distance. (4)

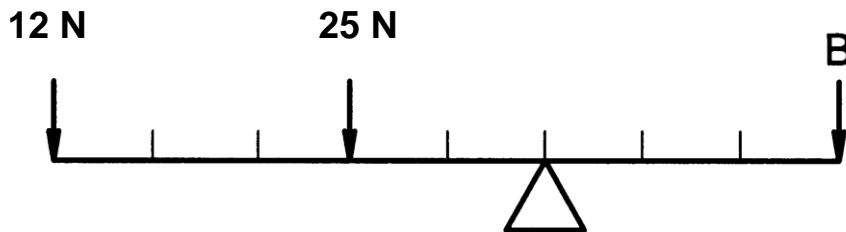


Fig. 2.5

- 2.6 Briefly describe the method we use to determine if the design of a frame structure is perfect by referring to examples. (4)
(30)

QUESTION 3

- 3.1 A mechanism is a device which changes an input motion and force into an output motion and force. Use an example to illustrate this statement. (3)
- 3.2 Calculate the kinetic energy of a car with a mass of 1,5 tons traveling at a velocity of 80 km/h. Use the formula: $E = \frac{1}{2}mv^2$ (3)
- 3.3 Friction plays an important part in mechanical devices.
- 3.3.1 Give two examples of instances where friction works to our advantage. (4)
- 3.3.2 Give two examples of instances where friction works to our disadvantage. (4)
- 3.4 Briefly define the concept of mechanical advantage. (2)
- 3.5 What will the mechanical advantage of a lever be if you use an effort of 450N to lift a load of 1 800N? (3)
- 3.6 Show by means of a sketch how a gear system could be used to decrease the output speed of a device. Indicate the number of teeth on the driver gear as well as those on the driven gear. (4)
- 3.7 Explain briefly why a wheelbarrow can be classified as a class 2 lever. (3)

- 3.8 Figure 3.8 shows a device which contains link mechanisms. Sketch the linkages inside the device that would be needed to allow for the indicated movements. (6)

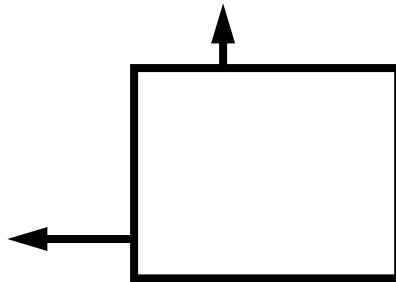


Fig. 3.8

(32)

Answer questions 4 to 7 in Examination book 2

QUESTION 4

- 4.1 Briefly explain the nature of *technology*. (5)
- 4.2 Briefly define in your own words the concept of *Technology Education*. (3)
- 4.3 Two types of technological knowledge are distinguished. Each of the two types of technological knowledge relates to a certain learning outcome in the NCS and a specific aim in the CAPS. Relate the two types of technological knowledge to the learning outcomes and specific aims, and provide reasons for the relationship. (4)
- 4.4 Distinguish between the two types of knowledge named in 1.3 by referring to the nature of each type of knowledge. (4)
- 4.5 Briefly explain the most important difference between teaching these two types of knowledge named in 4.3. (4)
- 4.6 Briefly provide reasons why technology should be offered to school learners. (5)

(25)

QUESTION 5

- 5.1 "Design is a particular kind of problem-solving."
Explain in which instances a technologist will apply the problem-solving and the design process. Give relevant examples. (5)
- 5.2 Name and discuss the steps of the dominant thinking sub-process of the technological process where the collection of information is involved. (5)
- 5.3 Name and discuss the relationship between the four thinking sub-processes that constitute the technological process. (5)

5.4 Stages of the technological process:

- 5.4.1 Name and briefly discuss the stages of the technological process. (5)
- 5.4.2 Based on how the stages of the technological process proceed, two types of stage-orientated models for the technological process are distinguished. Briefly discuss the most important similarities and differences between the two types of models. (3)
- 5.4.3 Briefly provide reasons why the stages of the technological process can be classified as procedural knowledge. (3)
- 5.4.4 Briefly discuss how you will teach learners the stages of the technological process as procedural knowledge. (5)

- 5.5 Briefly explain the essential differences between the thinking dimension and the stages of the technological process. (4)
- (35)**

QUESTION 6

- 6.1 Define the concept *process*. (2)
 - 6.2 Briefly describe your understanding of the concepts *critical* and *creative* thinking. (6)
 - 6.3 Briefly describe the role that critical and creative thinking should play in the technological process. (7)
 - 6.4 Name and discuss the steps of the design process. (5)
- (20)**

QUESTION 7

- 7.1 Name and discuss the steps of the problem-solving process. (4)
 - 7.2 Explain the difference between the design process and the problem-solving process and their relationship with the technological process. (6)
 - 7.3 Explain the relationship of each stage of the technological process with the thinking sub-processes. (10)
- (20)**

TOTAL: 200