THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

092

WORKSHOP TECHNOLOGY
(For Both School and Private Candidates)

Time: 3 Hours **Wednesday, 11th November 2015 a.m.**

Instructions

1. This paper consists of sections A, B and C.
2. Answer **all** questions in section A and B and **three (3)** questions from section C.
3. Calculators and cellular phones are **not** allowed in the examination room.
4. Write your **Examination Number** on every page of your answer booklet(s).

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SECTION A (10 Marks)

Answer **all** questions in this section.

1. For each of the items (i) – (x) choose the correct answer from among the given alternatives and write its letter beside the item number in your answer booklet provided.

(i) Which one of the following is the result of full annealing process?
A Refined grains. B Reduced softness. C Increased strains.
D Induced hardness. E Poor machinability.

(ii) Austenite steel can be transformed to martensitic steel by
A air blast cooling B slow cooling C furnace cooling
D soak pit cooling E rapid cooling.

(iii) The thermal expansion properties of polymers are
A greater than those of metals B less than those of metals
C the same as those of metals D equal to those of metals
E half of those of metals.

(iv) Which of the following materials is more elastic?
A Rubber B Plastic C Nylon
D Copper wire E Teflon.

(v) The algebraic difference between the maximum limit of size and the corresponding basic size is called
A actual deviation B upper deviation C zero deviation
D lower deviation E fundamental deviation.

(vi) Which of the following are the necessary properties of a lubricant?
A Fluidity and low viscosity.
B Hardness and strength.
C High viscosity and opaque.
D Oiliness and resistance to oxidation.
E High heat conductivity and transparency.

(vii) A steel with 0.8 percent carbon is known as
A ferritic steel B hypereutectoid steel C hypoeuctectoid steel
D austenitic steel E eutectoid steel.

(viii) Soft solder is an alloy of
A copper and zinc B zinc and brass C lead and tin
D lead and zinc E copper and tin.

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(ix) Which material is used to make cold chisels?
A Cast iron
B Wrought iron
C Mild steel
D High carbon steel
E Bronze.

(x) Which one among the following represents a pair of metals?
A Diamond and ceramic.
B Carbon and steel.
C Cast iron and nonferrous metal.
D Ferrous metal and synthetic material.
E Tungsten and ceramic.

SECTION B (30 Marks)

Answer **all** questions in this section.

2. Outline three purposes of using cutting lubricants.

3. Differentiate carburizing from carbonitriding processes.

4. Which results are expected when:
(a) A water hardening steel is quenched in oil,
(b) An oil hardening steel is quenched quickly in water.

5. List down three methods commonly used in identifying metals.

6. What alloys are obtained by the combination of the following metals?
(a) 88% copper, 10% tin and 2% zinc.
(b) 89.5% copper, 10% tin and 0.5% phosphorus.
(c) 67% nickel, 30% copper, 1.4% iron, 1% manganese 0.1% silicon and 0.2% carbon.

7. Define the following terms in relation to production of engineering components.
(a) Limits
(b) Fits
(c) Accuracy

8. What does the following colour codes indicate in metal identification?
(a) Blue
(b) Yellow
(c) Red

9. Distinguish between allowance and tolerance?

10. State three factors that may lead to the decision of using grease as a lubricant.

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11. Why cast iron is extensively used in industries for manufacturing components and machine parts? Give three reasons.

SECTION C (60 Marks)

Answer **three (3)** questions from this section.

12. (a) Describe how to perform the following:
    (i) Liquid carburizing
    (ii) Gas carburizing
    (06 marks)

    (b) What is the purpose of tempering a piece of steel?
    (02 marks)

    (c) What four factors that will affect the temperature at which a piece of steel is tempered?
    (04 marks)

    (d) Explain what will happen to steel if the tempering time is
    (i) too long
    (ii) too short.
    (04 marks)

    (e) Outline four reasons for hardening of steel components.
    (04 marks)

13. (a) Given the combination system of fit as $40\text{mm}\ \frac{H8}{f7}$

    Where $H8 = \begin{matrix}39\\0\end{matrix}$ and $f7 = \begin{matrix}-25\\-50\end{matrix}$

    (i) Give the upper and lower limit of the hole.
    (ii) Give the upper and lower limit of the shaft.
    (iii) Find the tolerances of both the hole and shaft.
    (iv) State the class of fit.
    (10 marks)

    (b) Name two systems of tolerance limits.
    (02 marks)

    (c) Given the hole dimensions as $^{4004}_{4000}$ in mm and the shaft dimensions as $^{3998}_{3995}$ in mm, compute the following:
    (i) Upper and lower limits of the hole diameter.
    (ii) Upper and lower limit of the shaft diameter.
    (iii) Hole tolerance.
    (iv) Shaft tolerance.
    (v) Maximum clearance.
    (vi) Minimum clearance.
    (08 marks)

14. (a) List down five chemical elements found in plain carbon steel.
    (05 marks)

    (b) Identify five properties that occur to steel when addition of alloying elements is done.
    (05 marks)

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(c) Name three categories of plain carbon steel and their ranges of carbon content in percentages. **(03 marks)**

(d) Define the terms:
(i) Casting of metals
(ii) Rolling of metals. **(03 marks)**

(e) (i) Outline four types of iron ores found in the earth's crust.
(ii) Explain two methods commonly used in extracting (mining) of iron ores in the earth's crust. **(04 marks)**

15. With a neat sketch of a heating/cooling curve, explain the behavioral changes that take place when steel is heated to 900 ^{0}C and then left to cool. **(20 marks)**

16. (a) (i) Elaborate three common forms of hollow steel sections by using sketches.
(ii) State five general uses for all the forms of material mentioned in (a) (i) above. **(12 marks)**

(b) (i) Give three effects of cutting metal without sufficient supply of lubricants.
(ii) What are the two commonly used methods of supplying lubricant to machine parts? **(08 marks)**

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