

وزارة التربية والتعليم



مركز القياس والتقويم التربوي
The Center for Educational Assessment and Measurement (CEAM)

امتحان دبلوم التعليم العام
لكلية الحرس السلطاني العماني التقنية (ثنائية اللغة)
الفصل الدراسي الأول - الدور الأول - للعام الدراسي ١٤٤٨/١٤٤٧ هـ - ٢٠٢٥ / ٢٠٢٦ م

تنبيه:
- المادة: الهندسة الميكانيكية.
- الأسئلة في (٥) صفحات.
- زمن الإجابة: ساعتان ونصف.
- الإجابة في الورقة نفسها.

تعليمات مهمة:

- يجب الحضور إلى قاعة الامتحان قبل عشر دقائق على الأقل من بدء زمن الامتحان.
- يجب إحضار أصل ما يثبت الهوية وإبرازها للعاملين بالامتحانات.
- يجب الالتزام بالزي (الدشداشة البيضاء والمصر أو الكمة للذكور) والزي المدرسي للطالبات ، ويستثنى من ذلك الدارسون من غير العمانيين بشرط الالتزام بالذوق العام، ويمنع على جميع المتقدمات ارتداء النقاب داخل المركز وقاعات الامتحان.
- يحظر على الممتحنين اصطحاب الهواتف النقالة وأجهزة النداء الآلي وآلات التصوير والحواسيب الشخصية والساعات الرقمية الذكية والآلات الحاسبة ذات الصفة التخزينية والمجلات والصحف والكتب الدراسية والدفاتر والمذكرات والحقائب اليدوية والآلات الحادة أو الأسلحة أياً كان نوعها وأي شيء له علاقة بالامتحان.
- يجب على الممتحن الامتثال لإجراءات التفتيش داخل المركز طوال أيام الامتحان.
- يجب على الممتحن التأكد من استلام دفتر امتحانه، مغلفاً بغلاف بلاستيكي شفاف وغير ممزق ، وهو مسؤول عنه حتى يسلمه لمراقبي اللجنة بعد الانتهاء من الإجابة.
- يجب الالتزام بضوابط إدارة امتحانات دبلوم التعليم العام وما في مستواه وأية مخالفة لهذه الضوابط تعرضك للتدابير والإجراءات والعقوبات المنصوص عليها بالقرار الوزاري رقم ٥٨٨ / ٢٠١٥.
- يقوم المتقدم بالإجابة عن أسئلة الامتحان المقالية بقلم الحبر (الأزرق أو الأسود).
- يقوم المتقدم بالإجابة عن أسئلة الاختيار من متعدد بتظليل الشكل (◯) وفق النموذج الآتي:

س – عاصمة سلطنة عمان هي:

◯ القاهرة ◯ الدوحة
● مسقط ◯ أبوظبي

ملاحظة: يتم تظليل الشكل (●) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.

صحيح ● **غير صحيح** ⊖ ◉ ◒ ⊗ ✓

مُسَوَّدَة، لا يتم تصحيحها

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1) **Figure 1-1** shows stress-strain diagram.

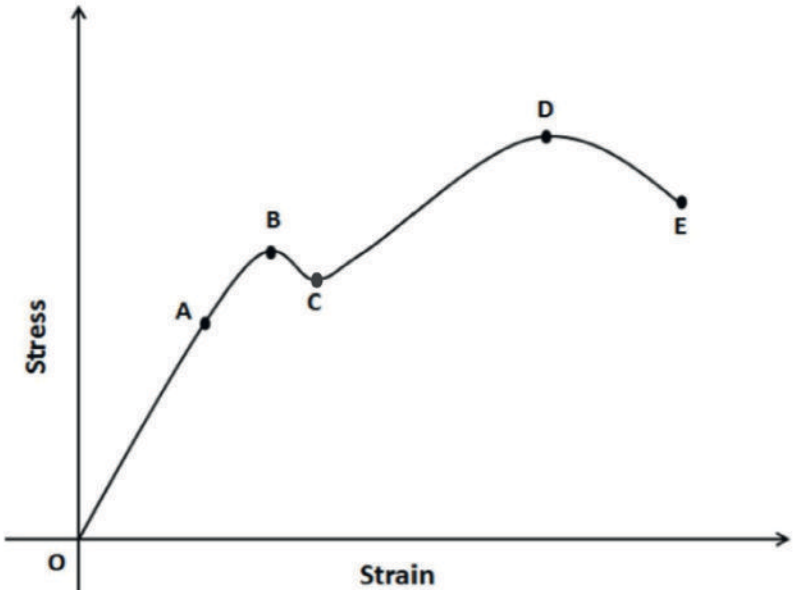


Figure 1-1

a. Identify the following points:

Point (C): _____

Point (D): _____ [2]

b. Which test can be used to produce this curve?

(Shade in the bubble (⬭) next to the correct answer).

⬭ Tensile strength ⬭ Plasticity

⬭ Compressive strength ⬭ Ductility [1]

2) Material **(A)** can change its shape under a compressive force, while material **(B)** has ability to absorb energy before fracturing.

Which of the following rows is correct about both materials **(A)** and **(B)**?

(Shade in the bubble (⬭) next to the correct answer).

	Material (A)	Material (B)
⬭	Toughness	Elasticity
⬭	Toughness	Malleability
⬭	Malleability	Toughness
⬭	Malleability	Elasticity

[1]

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3) Mention **two tests** used to measure the Toughness of a material and briefly **explain** how each test is performed.

Name of test	Explanation
1. _____	_____ _____ _____
2. _____	_____ _____ _____

[4]

4) Which curve in **Figure 4-1** represents the behavior of aluminum under test?

(Shade in the bubble (⬭) next to the correct answer).

⬭ 1 ⬭ 2

Explain your answer briefly.

_____

_____

_____

_____ [1]

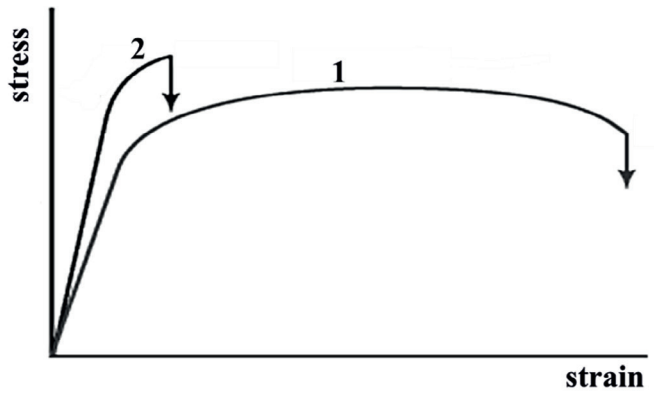


Figure 4-1

5) What is the scientific term that indicates wear-resistance and resistance against abrasion and scratching?

_____ [1]

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6) Which of the following ceramics is commonly used in engine parts?

(Shade in the bubble (⬭) next to the correct answer).

⬭ Tungsten carbides ⬭ Silicon nitride

⬭ Titanium carbides ⬭ Alumina oxide [1]

7) Which of the following is a natural composite material?

(Shade in the bubble (⬭) next to the correct answer).

⬭ Cement concrete ⬭ Fiber glass

⬭ Wood ⬭ Fiber reinforced plastics [1]

8) Name two important characteristics of Aluminum that make it **easy to fabricate**.

[2]

9) Write any **two** typical compositions of high-speed steel and **two** of its applications.

[4]

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10) Polymers are often used to make cable covers. Based on your knowledge of polymer properties, justify why they are suitable for this application.

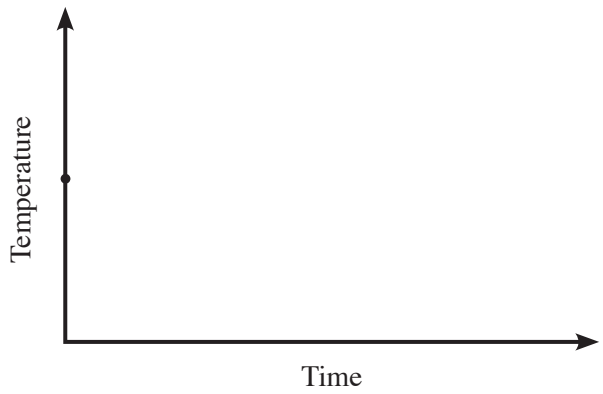
[2]

11) What is the primary purpose of the tempering process in heat treatment?

(Shade in the bubble (⬭) next to the correct answer).

- ⬭ Increase the material's hardness.
- ⬭ Reduce internal stresses and brittleness.
- ⬭ Remove impurities from the material's surface.
- ⬭ Improve the material's ability for cold forming. [1]

12) Describe the main steps of the general heat treatment process and support your answer with a figure.



[4]

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13) Compare between tempering and hardening in the table below.

Process	Advantages
Tempering	_____
Hardening	_____

[2]

14) What is the name of black phase in the microstructure of grey cast iron?

(Shade in the bubble (⬭) next to the correct answer).

⬭ Ferrite ⬭ Cementite

⬭ Austenite ⬭ Graphite flakes [1]

15) Identify the tools or machines used in the following stages of specimen preparation for microscopic examination:

a. Rough grinding stage: _____ [1]

b. Fine grinding stage: _____ [1]

[End of Examination]

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مركز القياس والتقويم التربوي
The Center for Educational Assessment and Measurement (CEAM)

Markting Guide of
General Education Diploma
Bilingual Private School
First Semester-First session
2025/2026

سلطنة عمان
وزارة التربية والتعليم

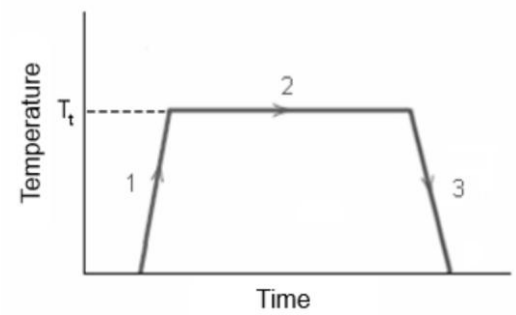
The Marking Guide is in (5) | Subject: Mechanical Engineering | Full

Item	Answer	Mark	Additional Information	Unit	Page	Assessment Objective
1a	C: lower yield stress point D: ultimate stress point	1 1		1	5	A
1b	Tensile strength	1	-	1	5	R
2	material (A): Malleability material (B): Toughness	1	-	1	7	R
3	1. IZOD: The test material here is first cut with a notch and then placed vertically and hit with a heavy pendulum. The test machine records the amount of energy taken by test piece 2. Charpy: test: The test material here is placed horizontally. In the Charpy method, there are two kinds of notches, the V-notch and the U-notch	1+1 1+1		1	9 10	K

Item	Answer	Mark	Additional Information	Unit	Page	Assessment Objective
4	(1) Because aluminum has the property of ductility and graph (1) represents the property of ductility.	1	Both parts must be correct to get (1) mark	1	7 9	A
5	Hardness	1	-	1	11	K

Item	Answer	Mark	Additional Information	Unit	Page	Assessment Objective
6	Silicon nitride	1	-	2	24	A
7	Wood	1	-	2	25	K
8	Soft and ductile	1+1		2	19	A
9	A typical HSS composition is: 18% tungsten, 4% Chromium, 1% Vanadium, 0.7% carbon, and the rest is Iron. Applications: Lathe cutting tools Drill bits	1+1 1 1	Two marks for any two composition And two marks for two of applications	2	17	K
10	- good insulators of heat and electricity. - corrosion resistant - have low melting points	1 1	Two marks for any two properties	2	21	R

سلطنة عمان
وزارة التربية والتعليم
دائرة الاختبارات ودائرة الامتحانات
لجنة الامتحانات الفنية

<table>
<tr><th>Item</th><th>Answer</th><th>Mark</th><th>Additional Information</th><th>Unit</th><th>Page</th><th>Assessment Objective</th></tr>
<tr><td>11</td><td>b. To reduce internal stresses and brittleness</td><td>1</td><td>-</td><td>3</td><td>32</td><td>A</td></tr>
<tr><td>12</td><td>1) Heating to T
2) Holding at T
3) Cooling to room temperature

</td><td>١
١
١
١</td><td></td><td>3</td><td>28</td><td>A&K</td></tr>
<tr><td>13</td><td>
<table>
<tr><th>Process</th><th>Advantages</th></tr>
<tr><td>Tempering</td><td>. Reduce brittleness.
. Minimize internal stresses.
. Reduce crack formation.
. To make the metal tough to resist shock and fatigue</td></tr>
<tr><td>Hardening</td><td>. Hardness improves
· Strength improves</td></tr>
</table>
</td><td>١
١</td><td></td><td>3</td><td>32</td><td>R</td></tr>
</table>

Item	Answer	Mark	Additional Information	Unit	Page	Assessment Objective
14	Graphite flakes	1		4	36	K
15	a. Bench grinder b. Emery papers	1 1		4	34	(K&A)

وزارة التعليم

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س - عاصمة سلطنة عمان هي:

▭ القاهرة ▭ الدوحة

▬ مسقط ▭ أبوظبي

ملاحظة: يتم تظليل الشكل (▬) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.

صحيح ▬ **غير صحيح** ▭ ◉ ◒ ☒ ☑

مُسَوَّدَة، لا يتم تصحيحها

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1) Which of the following is the correct types of material properties that have quantity of color, density and melting point?

(Shade in the bubble (⬭) next to the correct answer)

⬭ Thermal ⬭ Physical

⬭ Chemical ⬭ Electrical [1]

2) Describe how the tensile strength of material is tested.

Including the following in your answer:

- The name of the device.
- Adscription of tensile strength.
- How it works?
- Name of the curve obtained.

_____

_____

_____

_____ [4]

3) **Figure 3-1** show a graph of stress-strain.

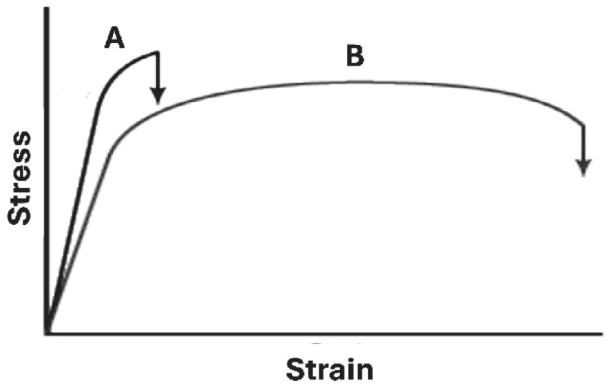


Figure 3-1

Give one material as an example that is represented by each of the following:

Curve (A): _____

Curve (B): _____ [2]

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4) **Figure 4-1** shows three hardness testing methods.

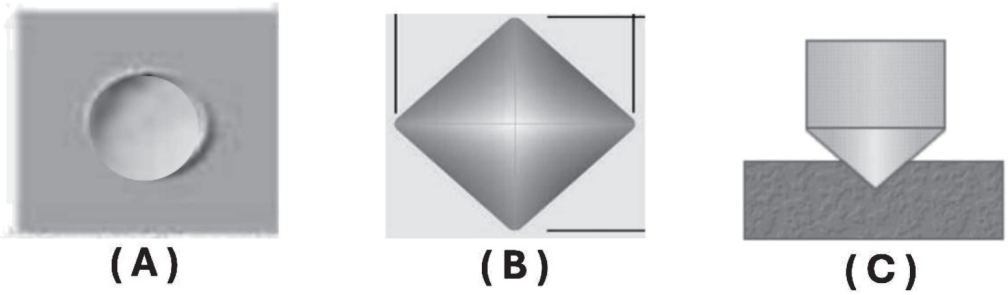


Figure 4-1

a. Which of the following rows represents the correct name for testing methods (**A**), (**B**) and (**C**):

(Shade in the bubble (🖵) next to the correct answer)

	(A)	(B)	(C)
🖵	Vickers	Brinell	Rockwell
🖵	Vickers	Rockwell	Brinell
🖵	Rockwell	Brinell	Vickers
🖵	Rockwell	Vickers	Brinell

[1]

b. Describe briefly how testing methods (**A**) and (**B**) are performed?

Test (**A**):

_____

_____

Test (**B**):

_____

_____ [2]

5) Which of the following elements in **plain carbon steel** have a content of **less than 0.6%?**

(Shade in the bubble (🖵) next to the correct answer)

🖵 Manganese 🖵 Nickel

🖵 Copper 🖵 Carbon [1]

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6) Which type of steel is used to make a steel axle?

(Shade in the bubble (⬭) next to the correct answer)

⬭ Cast iron ⬭ Medium carbon steel

⬭ Low carbon steel ⬭ High carbon steel [1]

7) List any three applications of copper alloys.

_____

_____

_____ [3]

8) Write two applications of each polymers in the table below.

Types of polymers	Applications
Thermoplastics	_____
Thermosetting plastics	_____
Elastomers	_____

[3]

9) Give two types of Engineering Ceramics.

_____

_____ [2]

10) Compare between low carbon steel and high carbon steel in the table below.

	Low carbon steel	High carbon steel
The more content (Ferrite/ Pearlite)	_____	_____

[2]

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11) State two of objectives of heat treatment process.

_____

_____ [2]

12) A softening process in which iron-based alloys are heated is known as:

(Shade in the bubble (⬭) next to the correct answer)

⬭ Normalizing ⬭ Annealing

⬭ Hardening ⬭ Tempering [1]

13) **Figure 13-1** shows a temperature time heat treatment cycle.

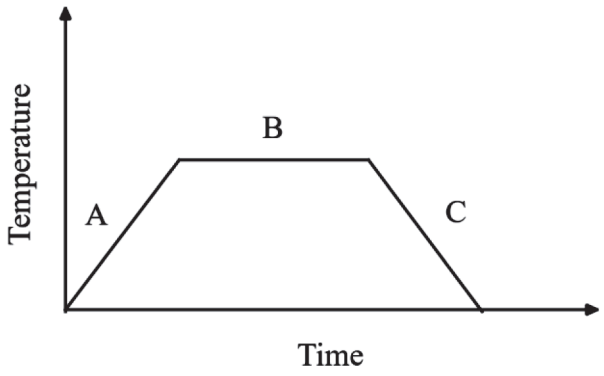


Figure 13-1

Write the name of each stage corresponding to labeled (A) and (B).

(A): _____

(B): _____ [2]

14) State the advantages of the annealing and the hardening process in the table below.

Process	Advantages
Annealing	_____ _____
Hardening	_____ _____

[2]

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15) What is the main purpose of applying chemical etchants to a metal specimen during metallographic preparation?

(Shade in the bubble (⬭) next to the correct answer)

- ⬭ To polish the surface further.
- ⬭ To increase the material's hardness.
- ⬭ To remove graphite flakes from the surface .
- ⬭ To reveal the microstructure for microscopic examination. [1]

[End of Examination]

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مُسَوَّدَة

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Marking Guide of
General Education Diploma
The Royal Guard of Oman Technical College
First Semester-second session
2025/2026

وزارة التعليم

The Marking Guide is in (4) pages	Subject: Mechanical Engineering	Full Marks: 30

Item	Answer	Mark	Additional Information	Unit	Page	Assessment Objective
1	Physical	1	-	1	4	K
2	-The name of the device is **a Universal Testing machine (UTM)**. -It can be described as **resistance of material to fracture during tension**. -Tensile strength is measured using **the tensile test**. The Tensile test is **performed by applying tensile load until the material fails**. -Name of the curve is called **Stress-Strain diagram**.	1 1 1 1	Accept any correct answer that indicates the correct meaning.	1	5	K
3	curve (A): ceramics ,glass, cast iron curve (B): aluminum, gold, silver, copper	1 1	One mark is given for any correct example of the property.	1	7	A
4 a	☐ (A) Rockwell ☐ (B) Brinell ☐ (C) Vickers	1	-	1	11 12	A
4 b	Test(A): A diamond or tungsten carbide ball is pressed into the material under a set load and the indentation is measured. Test (B):A hard steel ball is pressed into the material under a set load and the indentation is measured.	1 1	One mark for correct answer. Accept any correct answer that indicates the correct meaning.	1	9 10	R

<table>
<tr><th>Item</th><th>Answer</th><th>Mark</th><th>Additional Information</th><th>Unit</th><th>Page</th><th>Assessment Objective</th></tr>
<tr><td>5</td><td>Copper</td><td>1</td><td></td><td>2</td><td>15</td><td>K</td></tr>
<tr><td>6</td><td>High carbon steel</td><td>1</td><td></td><td>2</td><td>16</td><td>K</td></tr>
<tr><td>7</td><td>Power cables
Motor windings
Printed circuit boards (PCB)
Cooking utensils</td><td>1
1
1</td><td>Three marks for any three of applications</td><td>2</td><td>20</td><td>A</td></tr>
<tr><td>8</td><td><table><tr><th>Types of polymers</th><th>Applications</th></tr><tr><td>Thermoplastics</td><td>Cable covers
Polyethlene carry bags
Pvc pipes
Bottles
gears</td></tr><tr><td>Thermosetting plastics</td><td>Furniture
Switches
Electric plugs</td></tr><tr><td>Elastomers</td><td>Automobile tires
tubes</td></tr></table></td><td>1

1

1</td><td>Three marks for any three of applications</td><td>2</td><td>21
22</td><td>K</td></tr>
<tr><td>9</td><td>Oxides
Carbides
Nitrides</td><td>1
1</td><td>Tow marks for any two types</td><td>2</td><td>24</td><td>R</td></tr>
</table>

وزارة التعليم
المديرية العامة للتقويم التربوي
دائرة إدارة الامتحانات والاختبارات

Item	Answer	Mark	Additional Information	Unit	Page	Assessment Objective
10	<table><tr><th></th><th>Low carbon steel</th><th>High carbon steel</th></tr><tr><td>The more content (Ferrite/ Pearlite)</td><td>Ferrite</td><td>Pearlite</td></tr></table>	1+1	accept any objective for each	3	29	R
11	• Increase strength, hardness and wear resistance •Increase ductility and softness •Increase toughness • Remove internal stresses induced	1 1	(Accept any two objectives)	3	29	K
12	Normalizing	1		3	30	K
13	(A)Heating to T (B) Holding at T	1 1		3	28	A

<table>
<tr><th>Item</th><th>Answer</th><th>Mark</th><th>Additional Information</th><th>Unit</th><th>Page</th><th>Assessment Objective</th></tr>
<tr><td>14</td><td>
<table>
<tr><th>Process</th><th>Advantages</th></tr>
<tr><td>Annealing</td><td>- Material becomes soft with a uniform grain structure, improving ductility.
- Enhances machinability, making the material easier to cut.
- Reduces internal stresses.</td></tr>
<tr><td>Hardening</td><td>- Increases hardness, improving wear resistance.
- Enhances strength, making the material suitable for high-stress applications.</td></tr>
</table>
</td><td>1

1</td><td>(Accept one correct advantage of every process)</td><td>4</td><td>30
31</td><td>K</td></tr>
<tr><td>15</td><td>d. To reveal the microstructure for microscopic examination</td><td>1</td><td></td><td>4</td><td>34</td><td>A</td></tr>
</table>