These problems address topics from the NCEES FE Civil CBT Exam Specifications at https://ncees.org/wp-content/uploads/FE-Civil-CBT-specs-1.pdf, see below.

YouTube Playlist

FE Civil Review 2022

Materials

NCEES Fundamentals of Engineering (FE)
CIVIL CBT Exam Specifications

Effective Beginning with the July 2020 Examinations

Knowledge	Number of Questions
7. Materials	**5–8**
A. Mix design of concrete and asphalt	
B. Test methods and specifications of metals, concrete, aggregates, asphalt, and wood	
C. Physical and mechanical properties of metals, concrete, aggregates, asphalt, and wood	

Notes
V1.00 published 5/27/2022

A. Mix design of concrete and asphalt

Question 1: The amount of water specified in a concrete mix is typically based on which of the following conditions for the aggregate?

A. oven dry

B. air dry

C. saturated surface dry

D. moist

A. Mix design of concrete and asphalt

Question 2: Aggregate used in hot mix asphalt should be in which of the following conditions?

A. oven dry

B. air dry

C. saturated surface dry

D. moist

A. Mix design of concrete and asphalt

Question 3: Variables evaluated for the design of hot-mix asphalt include all the following except:

A. aggregate

B. asphalt binder content

C. ratio of aggregate to asphalt binder

D. water

A. Mix design of concrete and asphalt

Question 4: A concrete mix design is provided for a job with the following requirements per cubic yard:

Qty	Unit	Item	Notes
540	(lbs.)	Cement	ASTM C-150 Type I/II
1700	(lbs.)	Coarse Aggregate	ASTM #57 Gravel (weight is at SSD condition with 0.5% absorption)
1545	(lbs.)	Fine Aggregate	ASTM C-33 Sand (weight is at SSD condition with 1.0% absorption)
272	(lbs.)	Water	Potable
16.2	(ounces)	Water Reducer	ASTM C-494 Type A + F
4	(inches)	Slump	For additional slump, request superplasticizer
2.1	(percent)	Air Content	None

The moisture content of the coarse and fine aggregates is measured as 2% at the batch plant on a given day. For the aggregate moisture contents given, the amount of water that needs to be added to the mix design per cubic yard is most nearly:

A. 207 lbs.

B. 231 lbs.

C. 272 lbs.

D. 313 lbs.

A. Mix design of concrete and asphalt

Question 5: A concrete mix design requires 593 pounds of cement per cubic yard and has a maximum water-cement ratio specified as 0.45. Portland cement is the only cementitious material in the mix. If a 10-cubic yard truck arrives on-site with the batch ticket indicating 310 gallons of water were already included in the batch (excess aggregate moisture plus added water), the minimum number of gallons required to make the water-cement ratio exceed the specification is most nearly:

A. 0 (the w/c ratio already exceeds 0.45)

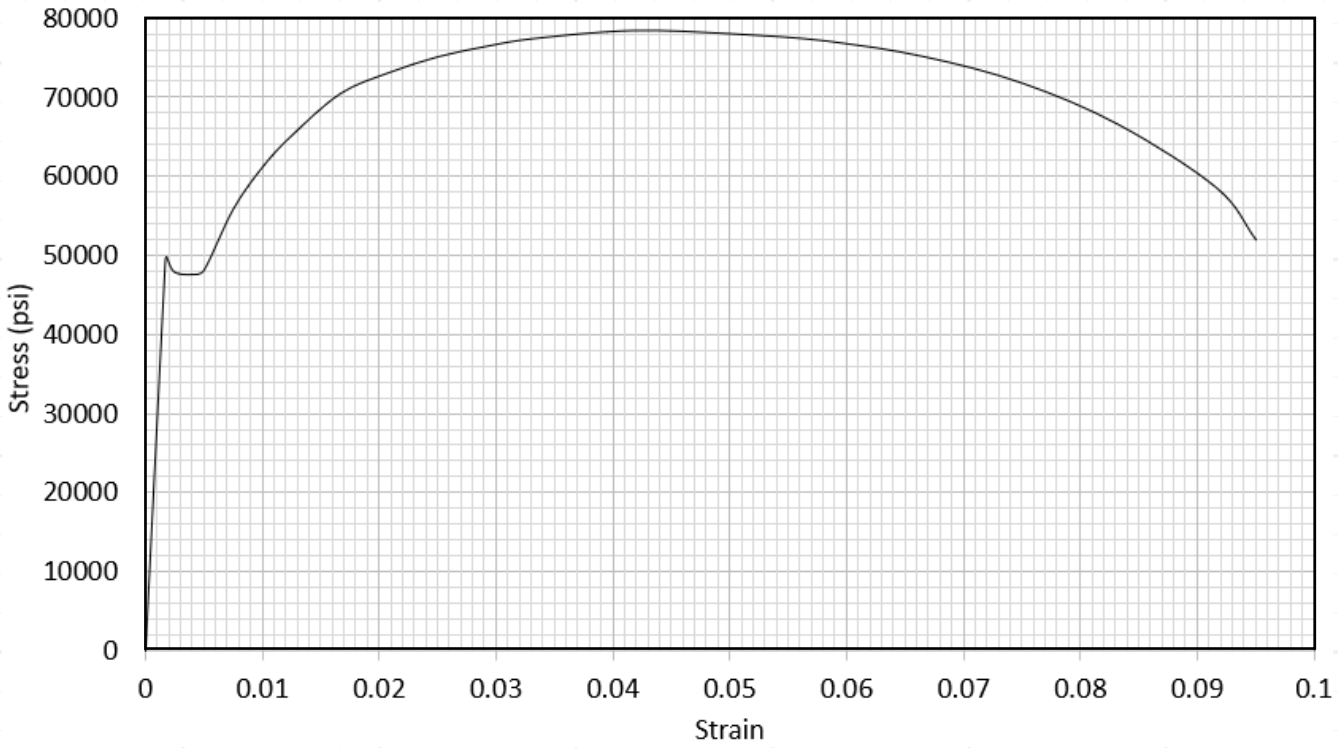
B. 5 gallons

C. 10 gallons

D. 15 gallons

B. Test methods and specifications of metals, concrete, aggregates, asphalt, and wood

Question 6: A plot showing stress versus strain is provided below.



The **type of test** that this plot would most likely result from is a:

A. Tensile test

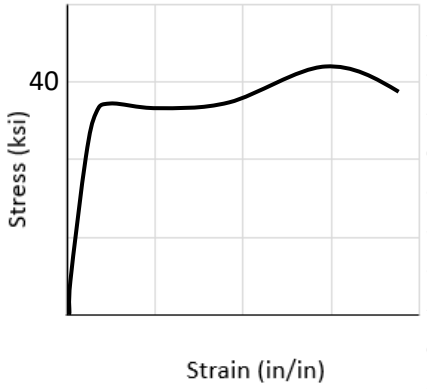
B. Ductility test

C. Charpy impact test

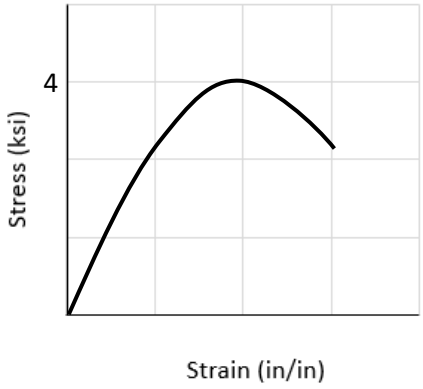
D. Marshall test

B. Test methods and specifications of metals, concrete, aggregates, asphalt, and wood

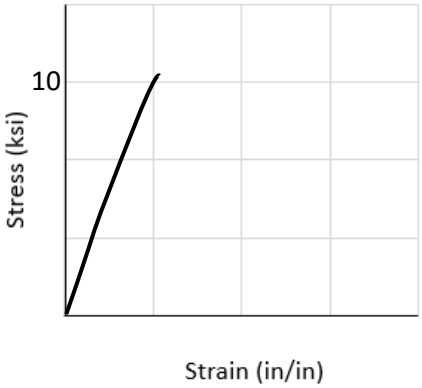
Question 7: Approximate Stress-strain curves for various materials are shown in the figures below (not to scale). Match the material type and loading condition with the appropriate diagram.



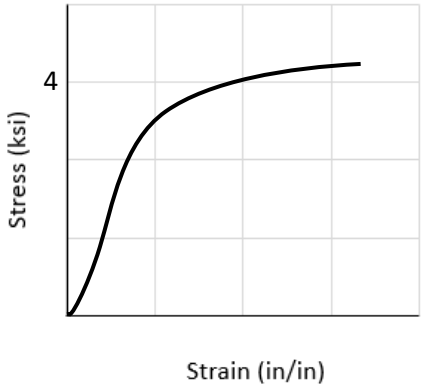
Material: ____



Material: ____



Material: ____



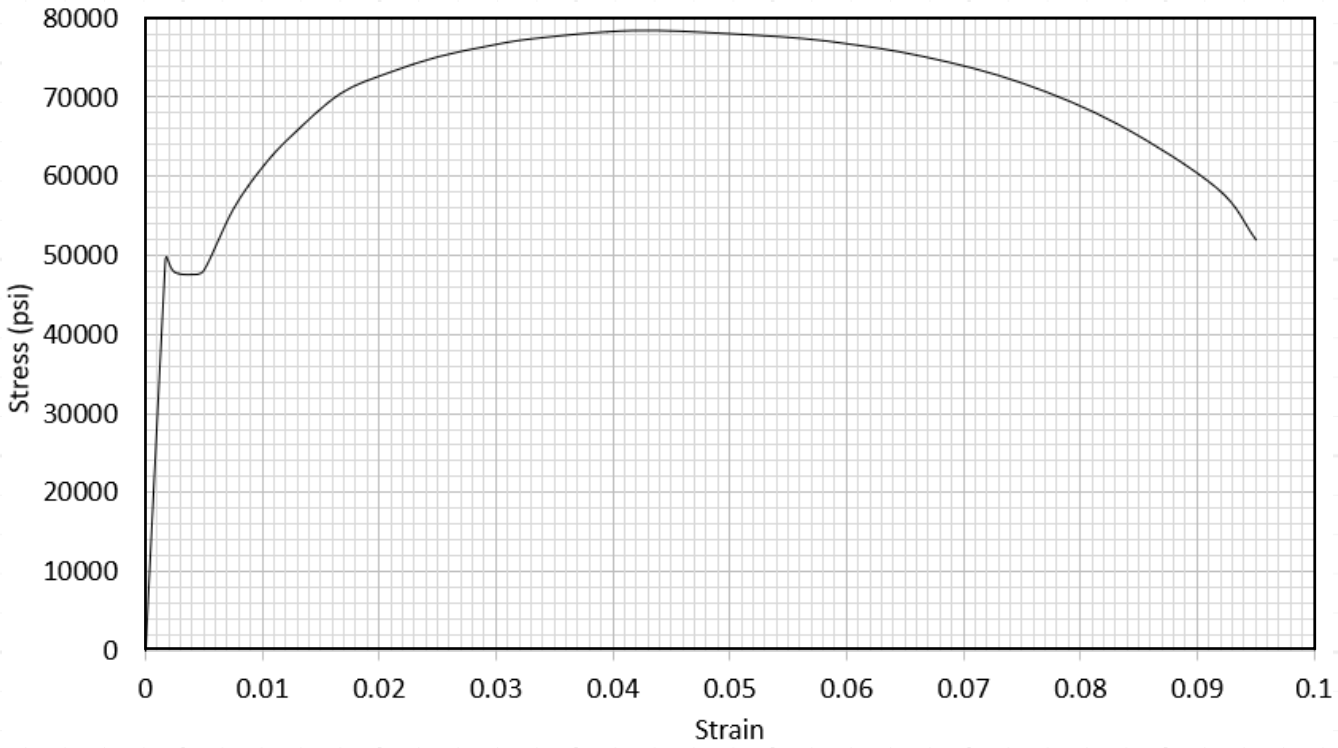
Material: ____

Materials:

- Wood in Compression (load parallel to grain)
- Wood in Tension (load parallel to grain)
- Concrete in Compression
- Steel in Tension

B. Test methods and specifications of metals, concrete, aggregates, asphalt, and wood

Question 8: A plot showing stress versus strain is provided below.



The **ultimate tensile strength** of this material is most nearly:

A. 47,500 psi

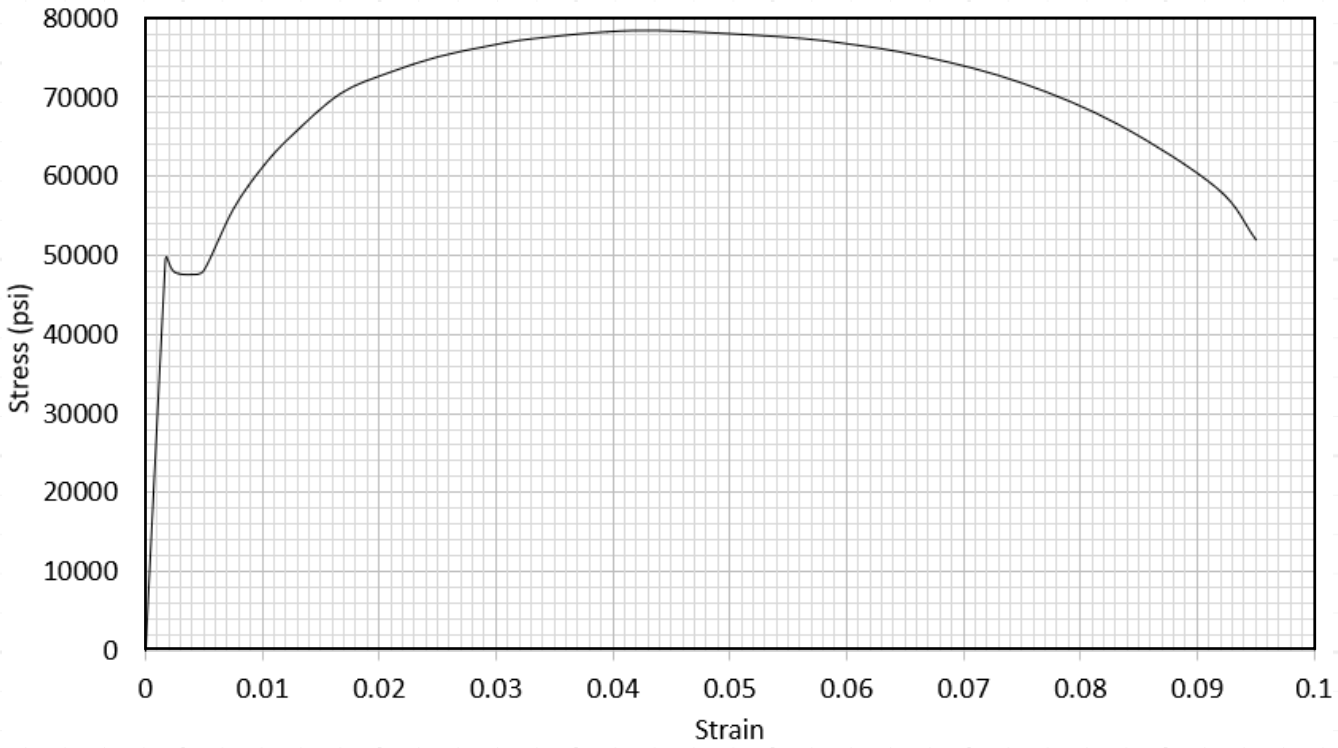
B. 50,000 psi

C. 52,000 psi

D. 78,500 psi

B. Test methods and specifications of metals, concrete, aggregates, asphalt, and wood

Question 9: A plot showing stress versus strain is provided below.



The **modulus of elasticity** of this material is most nearly:

A. 5,500,000 psi

B. 1,750,000 psi

C. 24,000,000 psi

D. 30,000,000 psi

C. Physical and mechanical properties of metals, concrete, aggregates, asphalt, and wood

Question 10: Select the materials that exhibit approximate linear elastic behavior to the points indicated:

- □ Steel up to the yield strength, F_y
- □ Steel up to the ultimate tensile strength, F_u
- □ Steel up to the failure strength, F_f
- □ Concrete up to 50% of its maximum compressive strength, $f_c'/2$
- □ Concrete up to its maximum compressive strength, f_c'
- □ Concrete up to its maximum compressive strain, ε_{cu}
- □ Concrete up to its modulus of rupture, f_r

C. Physical and mechanical properties of metals, concrete, aggregates, asphalt, and wood

Question 11: Steel reinforcement is typically added to concrete flexural members for all the following reasons except:

A. To allow for increased ductility and deformation in the beam prior to failure
B. To resist tensile forces developed due to the bending moment
C. Because steel and concrete have similar coefficients of thermal expansion
D. To eliminate tension cracking when bending moments exceed the rupture capacity of the concrete

C. Physical and mechanical properties of metals, concrete, aggregates, asphalt, and wood

Question 12: The modulus of elasticity of normal-weight concrete with a compressive strength of f_c' = 4,000 psi consistent with ACI 318 requirements is most nearly:

A. 1.1×10^5 psi

B. 3.6×10^6 psi

C. 3.8×10^6 psi

D. 4.0×10^6 psi

C. Physical and mechanical properties of metals, concrete, aggregates, asphalt, and wood

Question 13: Which of the following material properties can typically be used to describe wood?

A. Incombustible

B. Impermeable

C. Isotropic

D. Orthotropic

C. Physical and mechanical properties of metals, concrete, aggregates, asphalt, and wood

Question 14: From the following list, select the properties and characteristics that have an impact on the design tensile strength of sawn lumber:

- ☐ Moisture content
- ☐ Repetitive use
- ☐ Temperature
- ☐ Size
- ☐ Flat use
- ☐ Load duration

See https://awc.org/publications/2018-nds/ for standards related to Wood Construction.