PROJECT LEAD THE WAY
PLTW

CIVIL ENGINEERING AND ARCHITECTURE SAMPLE MULTIPLE CHOICE ITEMS

1. Which **best** describes a function of an architect?

a. Determine the soil type in order to size the foundation
b. Legally represent the buyer in the transaction of property
c. Size the pipes used to bring water from the water tower to the point of use
*d. Arrange interior space in order to create efficient traffic patterns

2. 

What style of architecture is often characterized by a balanced and symmetrical design, entry porch with columns, low pitched roof, fanlight over front door, double hung windows, and dentil molding, such as Thomas Jefferson's Monticello?

a. Tudor
*b. Federal
c. Victorian
d. Italianate

3.

Insulation	R-Value Per Inch $\left(\frac{ft^2 \cdot hr \cdot °F}{Btu}\right)$
Batt	3.0
Rigid Board Polystyrene	3.6

Using the information provided in the R-Value and Densities chart, which insulation choice has the lowest U factor?

a. 3.5 inches of batt insulation
b. 3.5 inches of rigid board polystyrene
c. 5.5 inches of batt insulation
*d. 5.5 inches of rigid board polystyrene

Wall dimensions and data	
Height	8 feet
Length	20 feet
Outside Temperature	10 ° F
Inside Temperature	65 ° F
Total Heat Transmission Load	628.5 Btu/hr
No windows or doors in the wall	

4.

Given the information in the table, what is the minimum R-value that will result in a total heat transmission load of 628.5 Btu/hr?

a.

$0.05 \frac{ft^2 \cdot hr \cdot °F}{Btu}$

b.

$0.07 \frac{ft^2 \cdot hr \cdot °F}{Btu}$

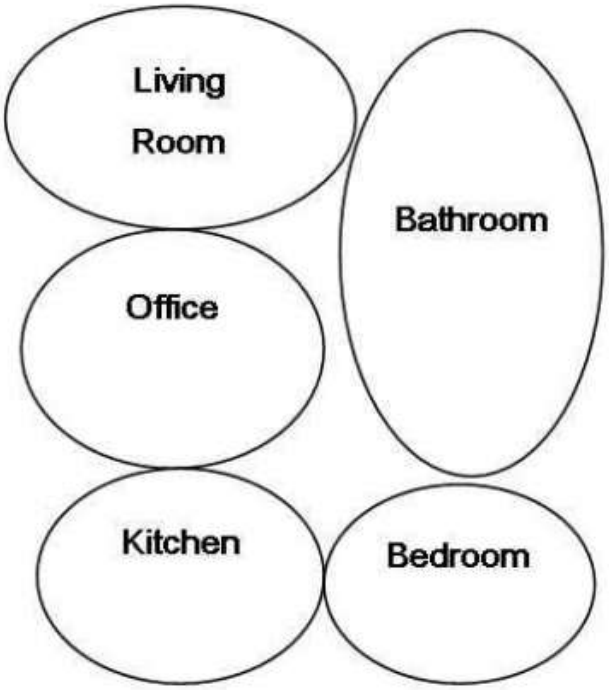
*c.

$14.00 \frac{ft^2 \cdot hr \cdot °F}{Btu}$

d.

$19.09 \frac{ft^2 \cdot hr \cdot °F}{Btu}$

5. **Use the image below to answer the question.**

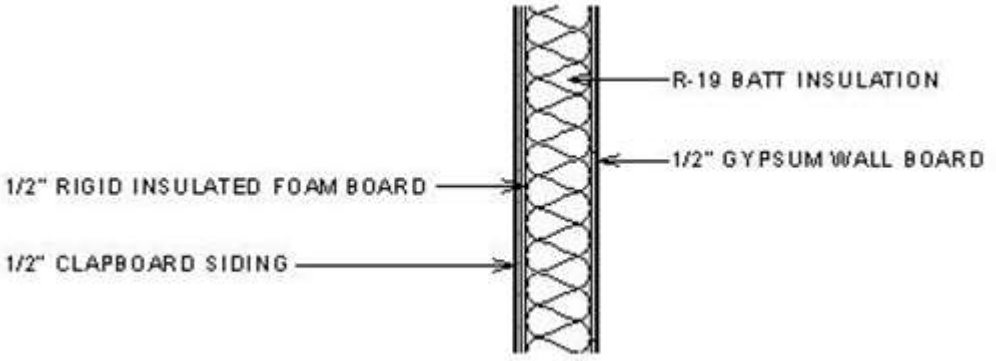


The bubble diagram represents a residential structure.

Which room is **most likely** drawn **incorrectly** on the bubble diagram?

a. Office
b. Bedroom
*c. Bathroom
d. Living Room

6. **Use the image below to answer the question.**



R-Value of Selected Materials (given in $\frac{ft^2 \cdot hr \cdot °F}{Btu}$)	
Rigid Insulated Foam Board	5.0 per inch
Clapboard Siding	1.2 per inch
Gypsum Wall Board	0.90 per inch

If the inside and outside air films are neglected, what is the R-value for the wall assembly shown in the diagram?

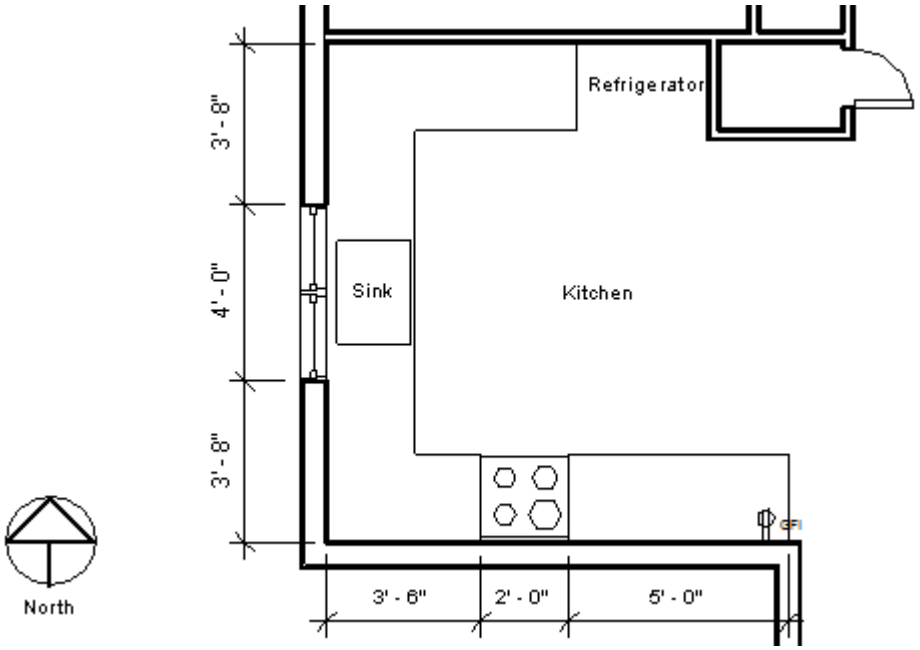
a. $26.1 \frac{ft^2 \cdot hr \cdot °F}{Btu}$

*b. $22.6 \frac{ft^2 \cdot hr \cdot °F}{Btu}$

c. $7.1 \frac{ft^2 \cdot hr \cdot °F}{Btu}$

d. $3.6 \frac{ft^2 \cdot hr \cdot °F}{Btu}$

7. **Use the image below to answer the question.**



Based on 2009 International Residential Code (IRC)

RECPTACLE OULETS

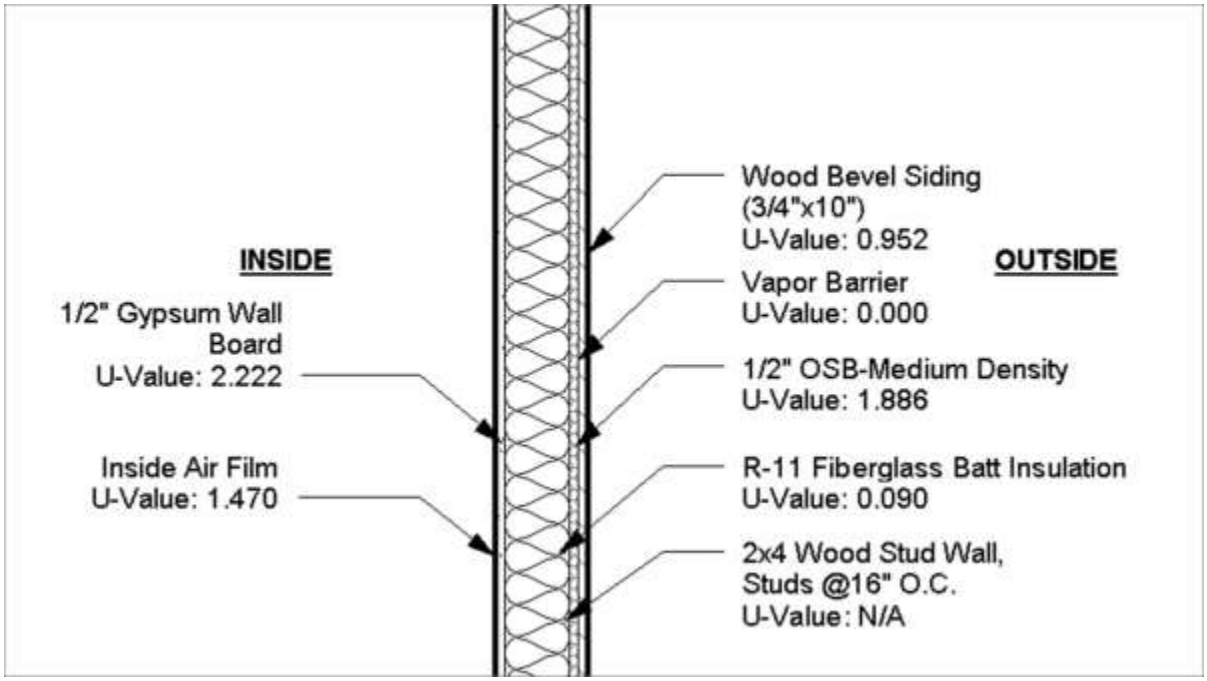
1. In kitchens, pantries, breakfast rooms, dining rooms and similar areas of dwelling units a receptacle outlet shall be installed at each wall countertop space 12 inches or wider. Receptacle outlets shall be installed so that no point along the wall line is more than 24 inches, measured horizontally from a receptacle outlet in that space.
   a. **Exception:** Receptacle outlets shall not be required on a wall directly behind a range, counter-mounted cooking unit or sink.

2. Countertop spaces separated by range tops, refrigerators, or sinks shall be considered as separate countertop spaces.

The floor plan of a kitchen and an excerpt of the residential electrical code are shown above. One GFI duplex outlet has been placed 6" from the edge of the cabinet on the south wall. To meet the code, how many **additional** GFI outlets are required for the south wall?

a. 3
b. 4
c. 5
*d. 2

8. **Use the image below to answer the question.**



A homeowner would like to improve the thermal resistance of their existing walls to reduce the heat loss in the winter. Which one of the following will **most** improve the home's thermal resistance?

*a. Remove the existing fiberglass batt insulation and replace with 3.5 inches of foam filled urethane insulation with an R-Value of 6.2 per inch
b. Remove the existing wood bevel siding and replace with 1/2" thick stucco with an R-Value of 0.2
c. Add another layer of 1/2" gypsum wall board to the inside walls with a U-Value of 2.222
d. Remove the existing wood bevel siding and replace with 3-1/2" thick brick with an R-Value of 0.2, and 2" rigid board extruded polystyrene with an R-Value of 5.0

9. A client has provided the following requirements for a wall:

- Brings in light
- Provides an aesthetically pleasing entrance
- Gives nearly unobstructed views of countryside

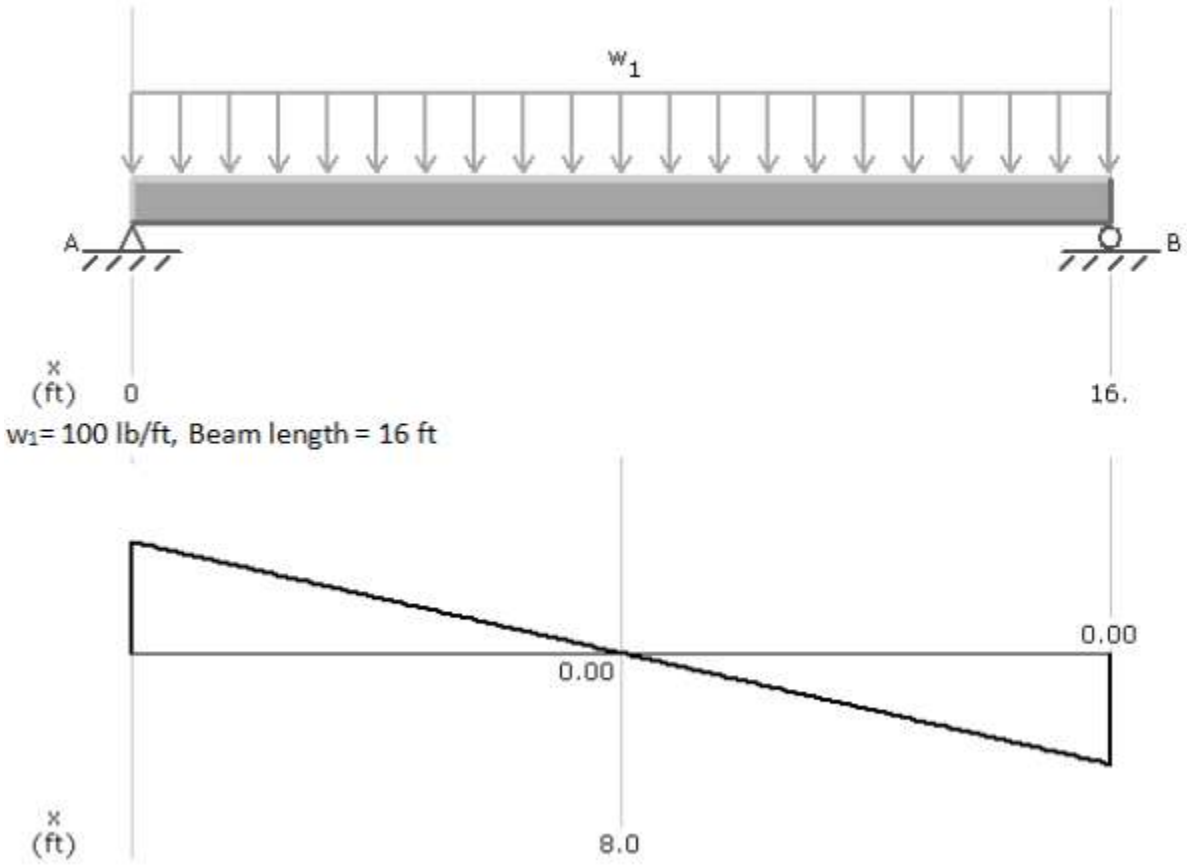
Which wall will best meet the requirements?

*a. Curtain wall
b. Tilt-up concrete
c. Cast-in-place concrete
d. Concrete masonry unit

10. What four mineral components of a soil sample are measured and compared in order to classify a soil in the Unified Soil Classification System?

a. Water, granules, sand, gravel
b. Granules, silt, clay, peat
c. Sand, silt, peat, clay
*d. Gravel, sand, silt, clay

11.



Which type of beam load is shown and what is the **maximum** shear force?

*a. The beam is loaded with a uniform load, and the maximum shear force is (100 lbs/ft)(16 ft)/2 = 800 lb.
b. The beam is loaded with a uniform load, and the maximum shear force is (100 lbs/ft)(16 ft) = 1600 lb.
c. The beam is loaded with a concentrated load, and the maximum shear force is (1600 lbs/ft)/(8 ft) = 200 lb.
d. The beam is loaded with a concentrated load, and the maximum shear force is (1/2)(100 lb/ft)(8 ft) = 400 lb.

12. **Use the table below to answer the question.**

Loading Condition	Maximum Allowed Deflection
Dead + Live Loads	L/240
Live Loads Only	L/360

An engineer is designing a 192-inch-long roof beam for a new building. Based on the maximum shear and bending moment, a preliminary beam size has been selected. To determine if the preliminary beam selection will meet code limits on deflection, the engineer calculated the deflection due to **dead and live load together** to be 1.1 inches. In addition, she calculated deflection for **live load only** to be 0.5 inches. The building code deflection limits are shown in the table, where L is the length of the beam.

Does the selected beam meet the deflection limits specified in the building code?

a. The beam meets the deflection limits for both loading conditions
b. The beam meets the deflection limits for dead and live load together, but fails to meet the deflection limit for live load only
*c. The beam meets the deflection limits for live load only, but fails to meet the deflection limit for dead and live load together
d. The beam fails to meet the deflection limits for both loading conditions

13. **Use the table below to answer the question.**

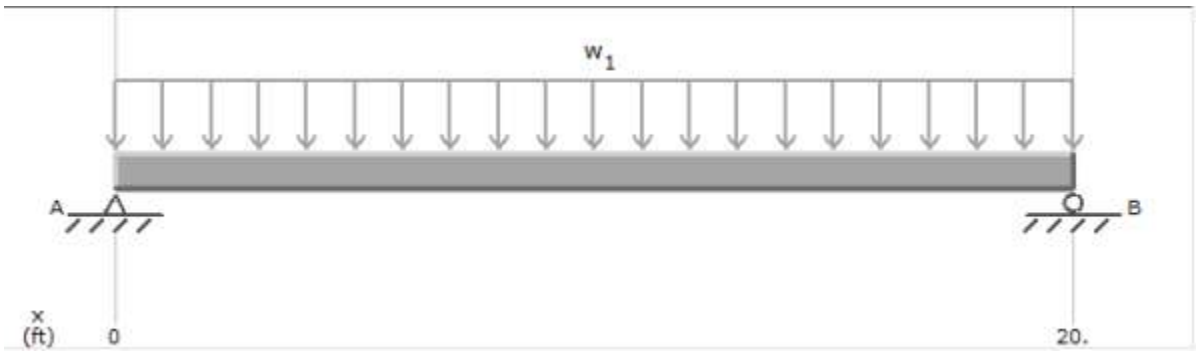
Soil Type	Allowable Soil Bearing (lb/ft^2)	Drainage
BEDROCK	4,000 to 12,000	Poor
GRAVELS	3,000	Good
GRAVELS w/ FINES	3,000	Good
SAND	2,000	Good
SAND W/ FINES	2,000	Good
SILT	1,500	Medium
CLAYS	1,500	Medium
ORGANICS	0 to 400	Poor

A low rise commercial building is to be built on a site where the footing will rest on a clayey gravel. Each column will carry a load of 27,000 lb. A table of soil bearing capacities is shown. Assume that concrete weighs 150 pounds per cubic foot.

Given that each concrete footing is 1'-6" thick, what are the plan dimensions for the most economical spread footing to safely support each column load?

a. 3'-0" x 3'-0"
*b. 3'-2" x 3'-2"
c. 3'-8" x 3'-8"
d. 4'-8" x 4'-8"

14. **Use the image below to answer the question.**



What is the **maximum** deflection of the steel beam represented by the beam diagram above if w_1 = 1200 lb/ft, the moment of inertia of the beam is I = 475 in.^{4}, and the modulus of elasticity of steel is 29,000,000 psi?

*a. 0.31 in.
b. 0.18 in.
c. 3.14 in.
d. 3.76 in.

15. **Use the table below to answer the question.**

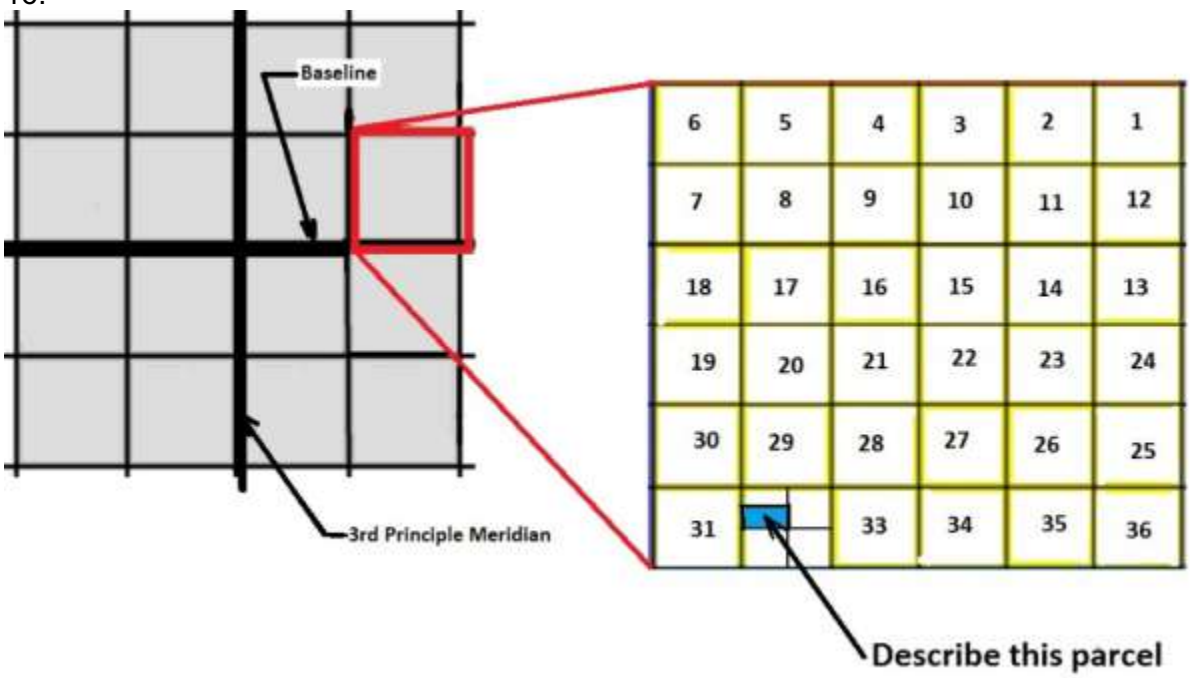
Presentation of Soil Sample Results

Item	Soil sample weight (grams)	Percent of soil sample	
GRAVEL	63		
Medium and coarse SAND	57		Total SAND, %
Fine SAND	10		
SILT and CLAY	13		

Review the presentation of the sieve analysis results of a soil sample. After completing the table and reviewing the USCS Soil Classification Chart in the formula sheet, which of the following is **most likely** the correct USCS classification of the soil?

a. GM-GC
b. SM-SC
c. GW-GM
*d. SP-SC

16.



Which description **best** describes the parcel indicated by the blue rectangle with the arrow pointing to it?

a. Township 2 East, Range 1 North, 3rd PM, Section 32: W1/2, N1/2
b. Township 1 North, Range 2 East, 3rd PM: S1/2, N1/2
*c. Township 1 North, Range 2 East, 3rd PM, Section 32: S1/2, NW1/4

17. A developer proposes to build a multistory office complex on a particular site. Which of the following would be important in determining the legality of constructing the office complex on the site in question?

*a. A review of the applicable land development regulations
b. A review of the applicable accessibility and ADA standards
c. A review of the applicable building code regulations
d. A review of the applicable energy code regulations