

NCARB

# PRACTICE EXAM

ARCHITECT REGISTRATION EXAMINATION® 5.0

## Project Planning and Design division



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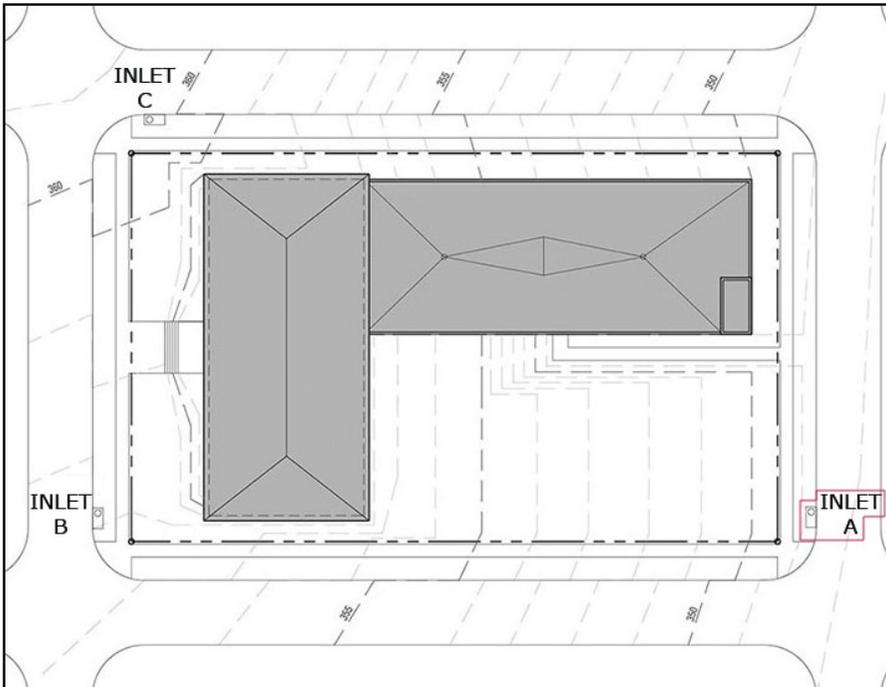
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**Question 1**

An architect is coordinating the drainage of a site with a municipality. The municipality confirms that all of the storm water inlets on the site have adequate capacity for the runoff volume created by the proposed construction.

Click on the inlet in the site plan that is most appropriate to connect the required site drainage.

**Correct answer:**



**CORRECT RESPONSE**

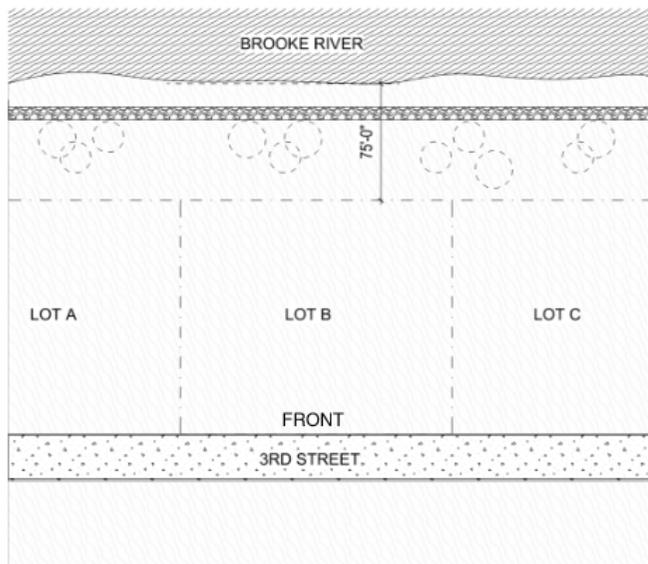
**Inlet A**

Water flows with gravity, and to avoid pumping, the flow line of the storm sewer must be below the level of site drainage. Inlet A is located at the site's lowest elevation.

**Section:** Project Integration of Program & Systems

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## Question 2



Refer to the exhibit.

A developer wants to build a new riverfront apartment building on Lot B and the architect needs to calculate the maximum building footprint. Site details follow:

- The street frontage is 175 feet and the lot depth is 150 feet.
- The AHJ requires a FAR of 2.5 and setbacks of 10 feet at the rear, front, and side.
- The north boundary is a community walkway along Brooke River.
- Brooke River's ordinary high water mark (OHWM) is 75 feet from the plot boundary.
- The AHJ does not permit buildings within 100 feet of a waterway's OHWM.

What is the maximum building footprint allowed on this site?

- A. 6,200 square feet
- B. 17,825 square feet
- C. 20,150 square feet
- D. 65,625 square feet

**Correct answer:** B

**CORRECT RESPONSE**  
17,825 square feet

### **CALCULATIONS**

1. Maximum footprint width: The side setbacks are 10 feet each, 175 feet (street frontage) - 10 feet (right side setback) - 10 feet (left side setback) = 155 feet
2. Maximum footprint depth: 150 feet (lot depth) - 10 feet (front setback) - 25 feet (rear setback, 100 feet from the OHWM) = 115 feet
3. Maximum footprint: 115 feet x 155 feet = 17,825 square feet

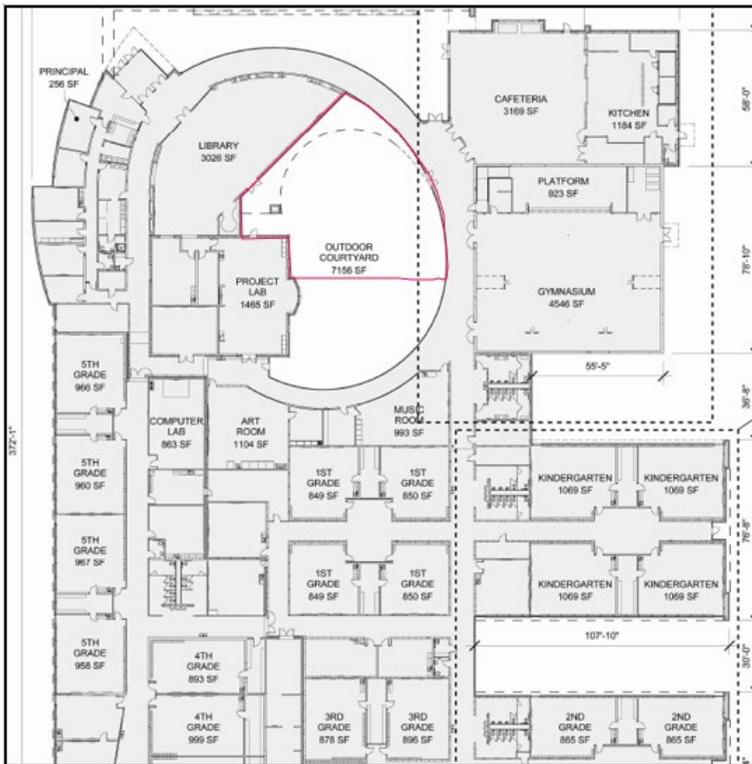
**Section:** Codes & Regulations

## Question 3

Due to space requirements, the library area of a school must be expanded contiguously by 2,000 square feet. The client has approved the project's exterior elevations, and the architect needs to choose an expansion area that has minimal impact on the layout.

Click on the area in the floor plan to indicate where the library should expand.

**Correct answer:**



**CORRECT RESPONSE**

**The Outdoor Courtyard area**

This is correct because it is contiguous with the Library and would have minimal impact on the school layout, requiring neither revision to the design of the building facade nor the other programmed spaces.

**Section:** Project Integration of Program & Systems

**Question 4**

The program for a new university recreation building requires large open gymnasiums and open plan exercise rooms for flexible space configurations with 40-foot bays. Additionally, the university wants a solution where the mechanical ductwork integrates with, rather than drops below, the structural members.

Which structural systems are appropriate for this building? **Check the two that apply.**

- A. Steel open web joists
- B. Engineered glulam truss
- C. Solid wood joists and girders
- D. Two-way concrete flat slabs
- E. Two-way concrete waffle slab
- F. One-way concrete slab and beam

**Correct answer:** AB

**CORRECT RESPONSES**

**Steel open web joists**

Steel open web joists span up to 65' and ductwork can run between or alongside the open web construction. This satisfies all requirements.

**Engineered glulam truss**

Engineered glulam trusses span upwards of 100', which satisfies the 40-foot bay requirement and provides areas in the truss to run mechanical ductwork.

**Section:** Building Systems, Materials, & Assemblies

**Question 5**

TABLE 1004.6 MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT

FUNCTION OF SPACE	OCCUPANT LOAD FACTOR*
Accessory storage areas, mechanical equipment room	300 gross
Agricultural building	300 gross
Aircraft hangars	500 gross
Airport terminal	
Baggage claim	20 gross
Baggage handling	300 gross
Concourse	100 gross
Waiting areas	15 gross
Assembly	
Gaming floors (keno, slots, etc.)	11 gross
Exhibit gallery and museum	30 net
Assembly with fixed seats	See Section 1004.6
Assembly without fixed seats	
Concentrated (chairs only—not fixed)	7 net
Standing space	5 net
Unconcentrated (tables and chairs)	15 net
Bowling centers, allow 5 persons for each lane including 15 feet of runway, and for additional areas	7 net

**1005.3.2 Other egress components.**

The capacity, in inches, of means of egress components other than stairways shall be calculated by multiplying the occupant load served by such component by a means of egress capacity factor of 0.2 inch (5.1 mm) per occupant.

Refer to the exhibit.

An architect is determining the size and number of doors for a large, rectangular assembly room that will be used as an exhibition gallery. The assembly room will be 150'-deep by 250'-long. The AHJ requires that all means of egress components other than stairways use an egress capacity factor of 0.2 inches per occupant. All assembly room exits will use double doors.

How many 60-inch clear width double door exits are required?

- A. 4 double door exits
- B. 5 double door exits
- C. 8 double door exits
- D. 9 double door exits

**Correct answer: B**

**CORRECT RESPONSE**  
**5 double door exits**

**CALCULATIONS**

1. Determine room size: 150 feet x 250 feet = 37,500 square feet
2. 37,500 square feet / 30 square feet per occupant (occupant load factor for an assembly space for exhibit galleries) = 1,250 occupants
3. Egress components other than stairwells require multiplying the occupant load served by a means of egress capacity factor of 0.2 inches per occupant.
4. 1,250 occupants x 0.2 inches = 250 inches of egress width required
5. 250 inches of egress width / 60 inches (double doors) = 4.17 doors, rounded up to 5

**Section:** Codes & Regulations

**Question 6**

An architect includes a computer server room in the design of a courthouse at the owner's request. The architect wants to make sure that the internal heat load in this room is addressed during design. The architect asks the owner to send a cut sheet for the servers that will be purchased.

With which consultant should the architect coordinate the server room equipment?

- A. Building enclosure consultant
- B. Mechanical engineer
- C. Roofing consultant

**Correct answer: B**

**CORRECT RESPONSE**  
**Mechanical engineer**

The mechanical engineer needs to use the HVAC system to address internal heat loads such as computer servers.

**Section:** Project Integration of Program & Systems

**Question 7**

LOCAL AVERAGE TEMPERATURE AND HUMIDITY												
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Avg. Temperature (°F)	54°F	57°F	63°F	69°F	75°F	80°F	89°F	92°F	82°F	74°F	62°F	55°F
Humidity (%)	74%	73%	75%	74%	75%	76%	80%	80%	78%	74%	73%	74%

Refer to the exhibit.

An architect is designing a single-family house on a hill. The architect wants to minimize solar gain and maximize natural ventilation.

Which one of the following locations for the house is most appropriate?

- A. Bottom of a south-facing slope
- B. Midpoint of a south-facing slope
- C. Top of a south-facing slope

**Correct answer: C**

**CORRECT RESPONSE**

**Top of a south-facing slope**

The table shows a hot and humid local climate. Therefore, the windy top is ideal for maximizing natural ventilation. Building on the south side of the hilltop also avoids the hot afternoon sun on the west side.

**Section:** Environmental Conditions & Context

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**Question 8**

An architect wants to encourage the cooling effect of natural ventilation in a large space.

Which one of the following design strategies should be used?

- A. Zone the activities of the space vertically.
- B. Orient the space on an east-west axis.
- C. Add high and low openings to the space.
- D. Design the space around a cold air sink.

**Correct answer: C**

**CORRECT RESPONSE**

**Add high and low openings to the space.**

The rate that air will move through a space and carry heat depends on the vertical distance between openings, their size, and the difference in temperature between the interior and exterior. A large space can take advantage of the natural effect of warm air rising by allowing it to leave through an opening at the top of the space. A lower opening will allow the cooler air located lower to be pulled in.

**Section:** Environmental Conditions & Context

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**Question 9**

An architect is specifying a fire suppression system for a small museum building that will house sensitive and expensive artifacts.

Which one of the following should the architect specify?

- A. Dry-pipe system
- B. Preaction system
- C. Deluge system
- D. Mist system

**Correct answer: B**

**CORRECT RESPONSE**

**Preaction system**

A preaction system must go through a two-step process before the sprinklers will release water. This system is designed to protect spaces with sensitive and expensive materials.

**Section:** Building Systems, Materials, & Assemblies

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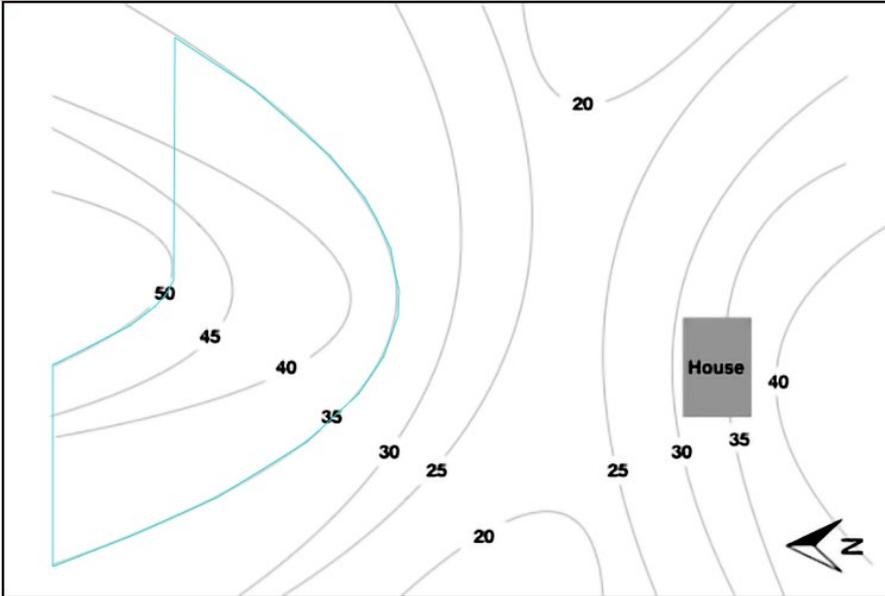
**Question 10**

An architect is locating an offsite wind turbine in a rural area with westerly winds. The location of the turbine must take advantage of site topography in order to capture as much wind as possible. Site characteristics and client requirements are as follows:

- The turbine should not be located near the house.
- The foundation of the existing house is at an elevation of 35'.
- The foundation of the turbine must be at a higher elevation than the foundation of the existing house.
- The foundation of the turbine cannot be constructed at elevations higher than 50' due to the presence of rocky outcroppings.

Click on the area in the topographic map to indicate where the wind turbine should be located.

**Correct answer:**



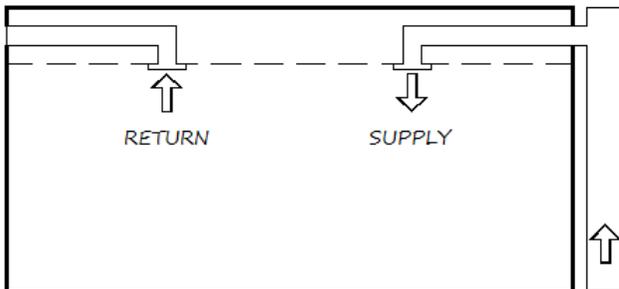
**CORRECT RESPONSE**

**Windward side of the north hill between an elevation of 35' and 50'**

The most appropriate location for the wind turbine is on the windward side of the north hill. Rocky outcroppings at 50' prevent building above that elevation, and the house at 35' prevents building the turbine below that elevation, leaving a range between 35' and 50' for the location of the wind turbine.

**Section:** Environmental Conditions & Context

**Question 11**



Refer to the exhibit.

Which type of HVAC system is indicated in the schematic diagram?

- A. Constant air-volume
- B. Variable air-volume
- C. Terminal reheat
- D. Dual duct

**Correct answer:** A

**CORRECT RESPONSE**

**Constant air-volume**

The diagram depicts a single duct constant air volume system. This system delivers conditioned air at a constant temperature through a low-velocity duct system.

**Section:** Building Systems, Materials, & Assemblies

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**Question 12**

An architect is specifying a finish for exposed metal. The architect wants to select the most sustainable finish.

Which one of the following finishes should the architect specify?

- A. Lacquer
- B. Epoxy paint
- C. Chrome plating
- D. Powder coating

**Correct answer:** D

**CORRECT RESPONSE**

**Powder coating**

When metal coatings are required, powder-coated fabrications can be specified as a solvent-free application. The powder overspray can also be reclaimed for reuse.

**Section:** Building Systems, Materials, & Assemblies

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**Question 13**

An architect is evaluating a proposed site for a new elementary school. Upon visiting the site, the architect observes the following:

- Significant erosion patterns on the adjacent property, which is at a much higher-grade elevation.
- Large amounts of sediment and soil deposits dispersed throughout the property.
- Signs of natural vegetation debris collected in piles throughout the site.

Based on these specific discoveries, which resources should the architect refer to before making a recommendation to the owner? **Check the three that apply.**

- A. United States Geological Survey (USGS) maps
- B. Zoning maps applicable to the site
- C. Topographic survey of the proposed site
- D. Geotechnical investigation reports
- E. Federal Emergency Management Agency (FEMA) maps
- F. United States Department of Agriculture (USDA) land surveys

**Correct answer:** ACE

**CORRECT RESPONSES**

**United States Geological Survey (USGS) maps**

The USGS is a valid source of topographic information for the adjacent properties not included on the site survey.

**Topographic survey of the proposed site**

A topographic survey will inform the site design, particularly regarding potential grade or drainage information.

**Federal Emergency Management Agency (FEMA) maps**

FEMA maps will provide information on potential site flood risks, drainage concerns, etc. that may be evidenced by deposits on the site.

**Section:** Environmental Conditions & Context

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**Question 14**

An architect is designing a building in a cold climate and wants to eliminate condensation on the interior surface of the building's exterior walls.

Which of the following will help eliminate condensation? **Check the three that apply.**

- A. Increasing the wall insulation
- B. Eliminating the wall insulation
- C. Raising the interior relative humidity
- D. Lowering the interior relative humidity
- E. Raising the surface temperature of the affected area
- F. Lowering the surface temperature of the affected area

**Correct answer:** ADE

**CORRECT RESPONSES**

**Increasing the wall insulation**

Thermal insulation will help to reduce the amount of heat lost from a building and raise the internal temperature of the wall near the interior surface.

**Lowering the interior relative humidity**

Lower humidity will result in a lower dew point for the air within the space - thus lowering the chance of condensation.

**Raising the surface temperature of the affected area**

Increasing the surface temperature will reduce cooling of any moisture-laden air and, consequently, the amount of condensation.

**Section:** Project Integration of Program & Systems

**Question 15**

TABLE 1004.5  
MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT

FUNCTION OF SPACE	OCCUPANT LOAD FACTOR <sup>a</sup>
Assembly	11 gross
Gaming floors (keno, slots, etc.)	30 net
Exhibit gallery and museum	
Assembly with fixed seats	See Section 1004.6
Assembly without fixed seats	
Concentrated (chairs only—not fixed)	7 net
Standing space	5 net
Unconcentrated (tables and chairs)	15 net

**1004.6 Fixed seating.** For areas having *fixed seats* and *aisles*, the *occupant load* shall be determined by the number of *fixed seats* installed therein. The *occupant load* for areas in which *fixed seating* is not installed, such as waiting spaces, shall be determined in accordance with Section 1004.5 and added to the number of *fixed seats*.

Table 2902.1 MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES

DESCRIPTION	WATER CLOSETS (URINALS SEE SECTION 424.2 OF THE INTERNATIONAL PLUMBING CODE)		LAVATORY	
	Male	Female	Male	Female
Coliseums, arenas, skating rinks, pools and tennis courts for indoor sporting events and activities	1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500	1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520	1 per 200	1 per 150
Stadiums, amusement parks, bleachers and grandstands for outdoor sporting events and activities	1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500	1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520	1 per 200	1 per 150

Refer to the exhibit.

An architect is renovating an existing sports arena. There are 52 suites on the arena's suite level at 250 square feet each. Each suite has 12 fixed seats only with views to the field below. Suites are the only spaces on this level. There are currently two female lavatories on the suite level.

How many additional female lavatories are required on the suite level?

- A. 1 lavatory
- B. 2 lavatories
- C. 3 lavatories
- D. 4 lavatories

**Correct answer:** A

**CORRECT RESPONSE**

**1 lavatory**

IBC Section 1004.6 states that for assembly spaces with fixed seats, the occupant load is determined by the number of fixed seats rather than occupant load factor. The occupant load must then be determined and divided by two in order to arrive at the number of females that the restroom on the sports arena's suite level will serve. Table 2902.1 is then used to determine the number of lavatories needed for the suite level's female occupants.

**CALCULATIONS**

1. For the occupant load: 52 (number of suites) x 12 (number of fixed seats in each suite) = 624 occupants
2. For the number of female occupants: 624 (number of suite occupants) / 2 (even distribution between male/female occupants per code) = 312 females
3. For the lavatories needed in the sports arena's suite level female restroom: 312 / 150 (number of females for which one lavatory is required) = 2.08 lavatories; round up when determining required lavatories to 3
4. 3 (lavatories needed) - 2 (existing lavatories) = 1 additional lavatory needed

**Section:** Codes & Regulations

**Question 16**

An architect is using environmentally responsive and sustainable practices for the design of a farm-to-table restaurant. The owner has asked the architect to develop a water harvesting system that will collect water from the roof and reuse it for the watering of the restaurant's vegetable garden.

Which roofing material should the architect specify?

- A. Treated cedar shingles
- B. Galvanized standing seam
- C. Asphalt composition shingles

**Correct answer:** B

**CORRECT RESPONSE**

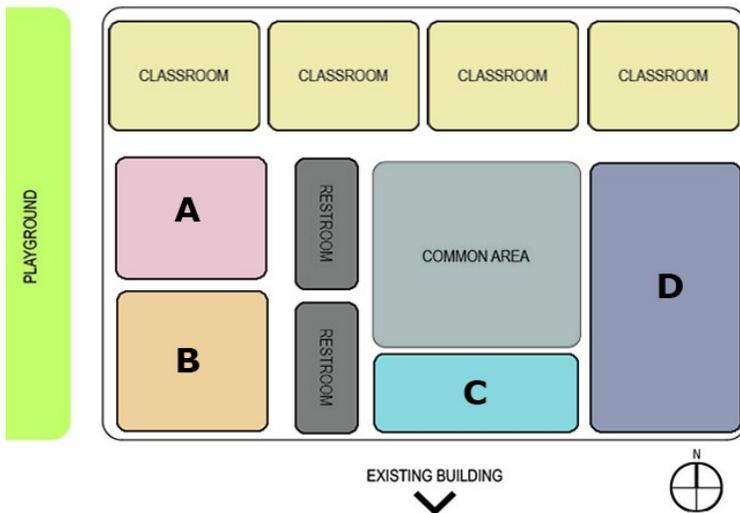
**Galvanized standing seam**

Galvanized metal roofing is an environmentally friendly roofing material that will not contaminate the collected water.

**Section:** Building Systems, Materials, & Assemblies

**Question 17**

Program Summary			
	Quantity	Area	Requirements
Vestibule	1	400	Connects the existing building to the common area
Common Area	1	1000	Multipurpose gathering/circulation space
Classroom	4	450	Need indirect natural light and playground access via corridor
Science Lab	1	1000	Accessed from the Common Area
Teachers Lounge	1	500	Visual control over the playground
Workroom	1	550	Adjacent to the Teachers Lounge
Restroom	2	200	Accessed from the Common Area



Refer to the exhibit.

A school is adding a small classroom building to its existing campus. The new building will be connected to the existing building by a covered walkway.

Which bubble in the plan diagram is the appropriate location for the Teachers Lounge?

- A. A
- B. B
- C. C
- D. D

**Correct answer:** A

**CORRECT RESPONSE**

**A**

In order to have the best visual control over the playground, the Teachers Lounge must be placed centrally along the west wall.

**Section:** Project Integration of Program & Systems

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**Question 18**

During the DD phase for a 10-story office building, the owner requests a 50% increase in air exchange per hour (ACH) capacity to reduce the risk of spreading infectious respiratory diseases. The SD drawings show chillers and air-handling units on the rooftop.

Which of the following changes will occur due to the ACH increase? **Check the two that apply.**

- A. A decrease in occupant load for the entire building.
- B. An increase in the dead load on the roof.
- C. A decrease in shaft spaces on all levels.
- D. An increase in shaft spaces on all levels.
- E. A decrease in the water service pressure for the entire building.
- F. An increase in the water service pressure for the entire building.

**Correct answer:** BD

**CORRECT RESPONSES**

**An increase in the dead load on the roof.**

Roof dead load will increase because of the additional HVAC equipment on rooftop.

**An increase in shaft spaces on all levels.**

Shaft spaces will increase in order to accommodate the ducting needed for additional air exchange.

**Section:** Project Integration of Program & Systems

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**Question 19**

Which of the following are reasons to specify floor-mounted water closets instead of wall-hung water closets in a back-to-back arrangement with an identical number of fixtures? **Check the two that apply.**

- A. Fewer cleanouts required
- B. Less sanitary/waste piping
- C. Smaller plumbing chase size
- D. Easier to clean water closet area
- E. Lower installation costs for each fixture
- F. Greater selection of fitting and piping materials

**Correct answer:** CE

**CORRECT RESPONSES**

**Smaller plumbing chase size**

A carrier is required for wall-hung water closets and this requires a larger chase to accommodate it.

**Lower installation costs for each fixture**

Floor-mounted water closets do not require the installation of a carrier, which requires more labor and material costs.

**Section:** Building Systems, Materials, & Assemblies

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### Question 20

An architect is designing a building that contains ten sleeping units with attached restrooms. During the design development phase, the client asks the architect to change five of the sleeping units into dwelling units.

What should the architect add to convert the sleeping units into dwelling units?

- A. Office space
- B. Kitchen
- C. Living room

**Correct answer: B**

#### **CORRECT RESPONSE**

##### **Kitchen**

Sleeping units can have either sanitation or kitchen facilities but not both. A dwelling unit needs to have both sanitation and kitchen facilities. The addition of a kitchen would convert a sleeping unit into a dwelling unit.

**Section:** Project Costs & Budgeting

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### Question 21



Refer to the exhibit.

A new school is moving into an existing building. The school wants the spaces in the building to be used as efficiently as possible. The building code requires 20 nsf per student for classroom spaces.

A classroom for 20 students should be assigned to which of the following spaces?

- A. A
- B. B
- C. C
- D. D

**Correct answer: D**

#### **CORRECT RESPONSE**

##### **D**

A classroom for 20 students would require a minimum of 400 nsf.

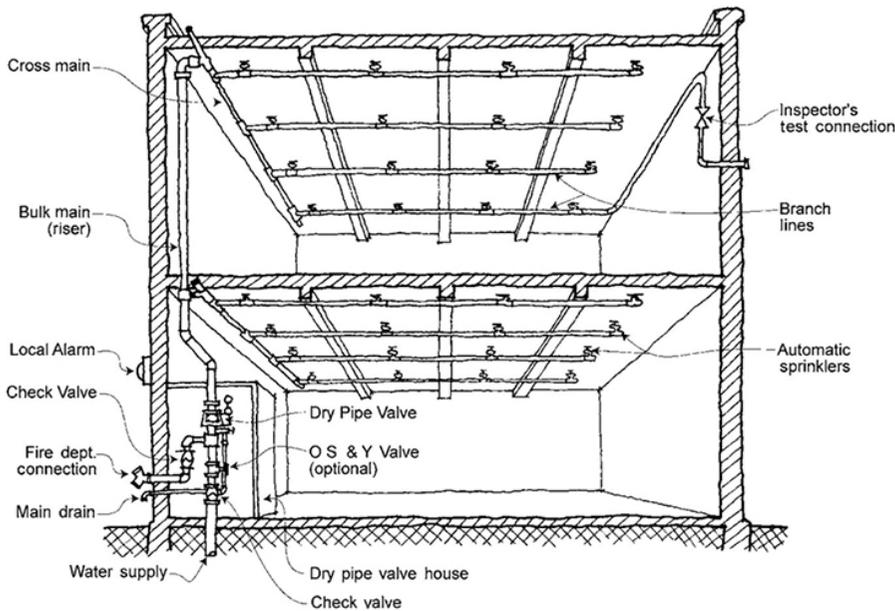
#### **CALCULATION**

20 nsf (loading factor) x 20 students (number of students in classroom) = 400 nsf space will be most efficient.

**Section:** Project Integration of Program & Systems

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### Question 22



Refer to the exhibit.

An architect is selecting a sprinkler system for a building in a cold climate.

For which of the following should the sprinkler system be used? **Check the two that apply.**

- A. Rare book areas
- B. Airplane hangars
- C. Typical office spaces
- D. Ventilated attic spaces
- E. Freezer storage rooms
- F. Computer server rooms

**Correct answer:** DE

**CORRECT RESPONSES**  
**Ventilated attic spaces**  
**Freezer storage room**

The illustration shows a dry pipe system. In both spaces, a dry pipe system is needed to prevent the pipes from freezing.

**Section:** Building Systems, Materials, & Assemblies

**Question 23**

An architect is hired to design accessible walking paths for a park that is on the National Register of Historic Places. In several areas, the architect finds that altering the existing walking paths would destroy an historically significant part of the site. The architect notes that only one accessible path can be provided.

How should the architect proceed?

- A. Provide at least one accessible path through the park.
- B. Provide a single accessible path to a viewpoint that can oversee the park.
- C. Contact the National Register of Historic Places to gain approval for modifying all walking paths.

**Correct answer:** A

**CORRECT RESPONSE**  
**Provide at least one accessible path through the park.**

If one accessible route through the park is possible, then that path must be designed.

**Section:** Codes & Regulations

**Question 24**

An architect is designing a multistory warehouse for heavy storage. The warehouse is to be constructed on a site where zoning regulations limit height.

Which one of the following structural systems is most appropriate?

- A. Cast-in-place, reinforced concrete columns, capital, drop, and flat slab floors.
- B. Cast-in-place, reinforced concrete columns, girders, beams, and joist slab floors.
- C. Structural steel columns, girders, beams, joists, steel form deck, and reinforced concrete floors.

**Correct answer: A**

**CORRECT RESPONSE**

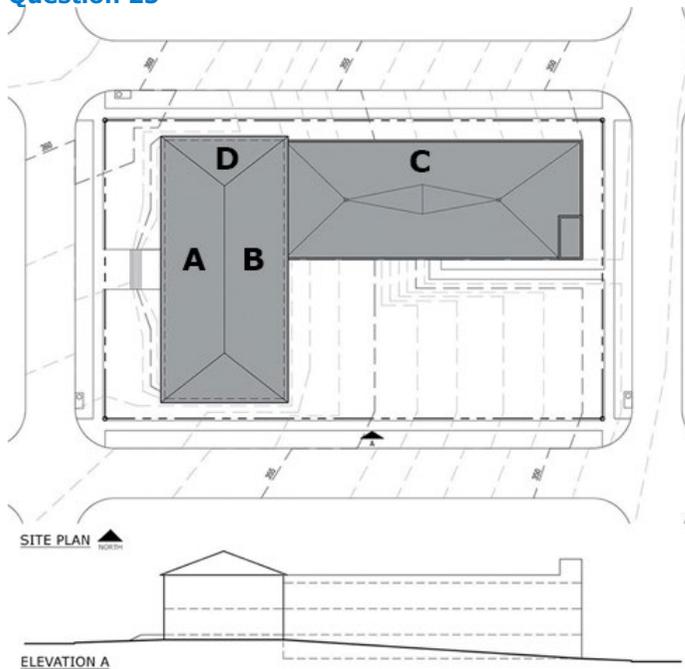
**Cast-in-place, reinforced concrete columns, capital, drop, and flat slab floors.**

Where building height is limited, the flat slab floor has the smallest ceiling-to-floor dimension and will allow for more stories than any of the other systems listed.

**Section:** Building Systems, Materials, & Assemblies

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**Question 25**



Refer to the exhibit.

An owner requests a 100 kW solar array. City ordinance requires solar equipment to be concealed from the public right of way. The architect needs to locate the system on the site plan to maximize performance.

Which letter on the site plan represents the most appropriate location for the solar array?

- A. A
- B. B
- C. C
- D. D

**Correct answer: C**

**CORRECT RESPONSE**

**C**

The panels should be placed on the part of the building with a flat roof to allow for proper sun angles and to conceal the equipment as required by zoning ordinance.

**Section:** Project Integration of Program & Systems

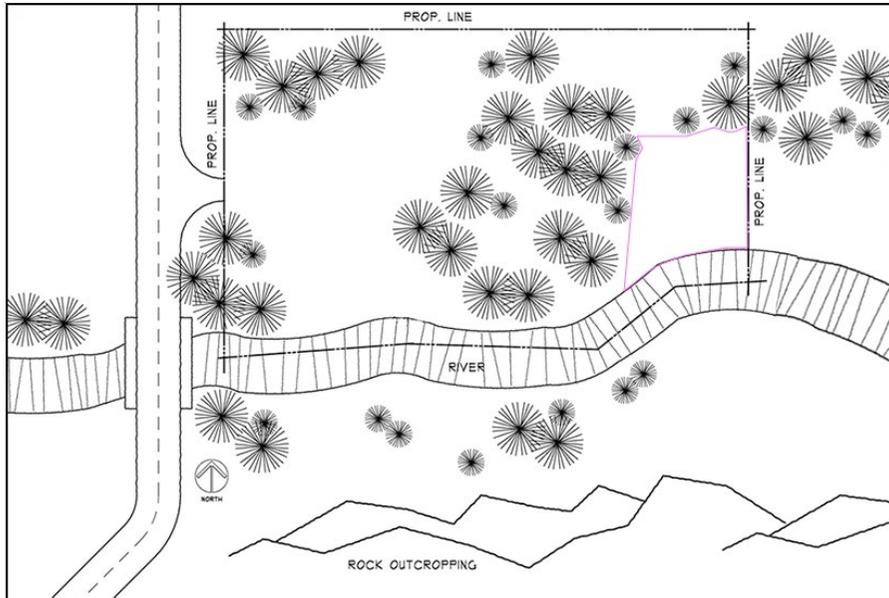
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### Question 26

An owner asks an architect to locate a new cabin on a wooded lot. The existing pine trees should be preserved as they will provide a wind break for the northwesterly winter winds. The owner wants the new cabin to have expansive views of the river and the rock outcropping, to receive morning light, and to be shielded from late afternoon sun. The cabin should also be located away from the road.

Click on the location in the site plan to indicate where the new cabin should be built.

**Correct answer:**



### **CORRECT RESPONSE**

#### **Southeast corner of the property**

The new cabin should be built at this location because it has existing trees that will provide a wind break from the northwest; it allows for morning sun; has views of the river and rock outcropping; and is located away from the road.

**Section:** Project Integration of Program & Systems

### Question 27

An architect is designing a project that requires the installation of four 12.5-ton roof top units (RTUs). After reviewing the plan sent from the mechanical engineer, the architect notices that the ductwork from the RTUs penetrate a rated roof assembly.

Which one of the following needs to be incorporated into the mechanical design at the roof assembly?

- A. Smoke filters
- B. Isolation curbs
- C. Fire dampers

**Correct answer:** C

### **CORRECT RESPONSE**

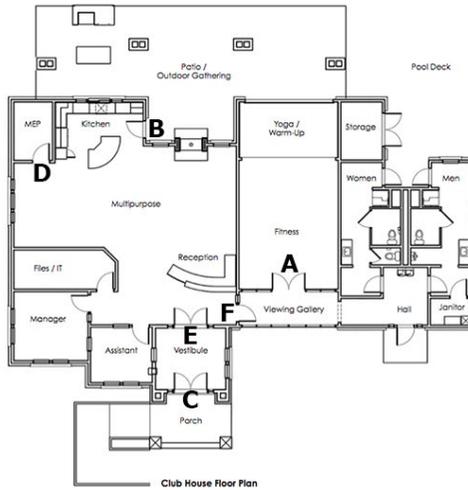
#### **Fire damper**

Fire dampers are used for smoke and fire control and would need to be installed at the roof assembly level in all ductwork penetrating the rated roof assembly.

**Section:** Project Integration of Program & Systems

### Question 28

CLUBHOUSE OCCUPANCY LOADS	
Multi-Purpose/Kitchen/Reception/Closing Room	82 occupants
MEP Closet	1 occupant
Fitness	13 occupants
Manager's Office	2 occupants
Assistant's Office	2 occupants
Janitor's Closet	1 occupant
File/IT Room	1 occupant
Outdoor Gathering	73 occupants



Refer to the exhibit.

While reviewing a drawing set for an apartment complex's clubhouse, an architect notices that some doors do not swing in a code-compliant direction.

Which of the following doors in the floor plan need to be revised to comply with code? **Check the three that apply.**

- A. A
- B. B
- C. C
- D. D
- E. E
- F. F

**Correct answer:** BCE

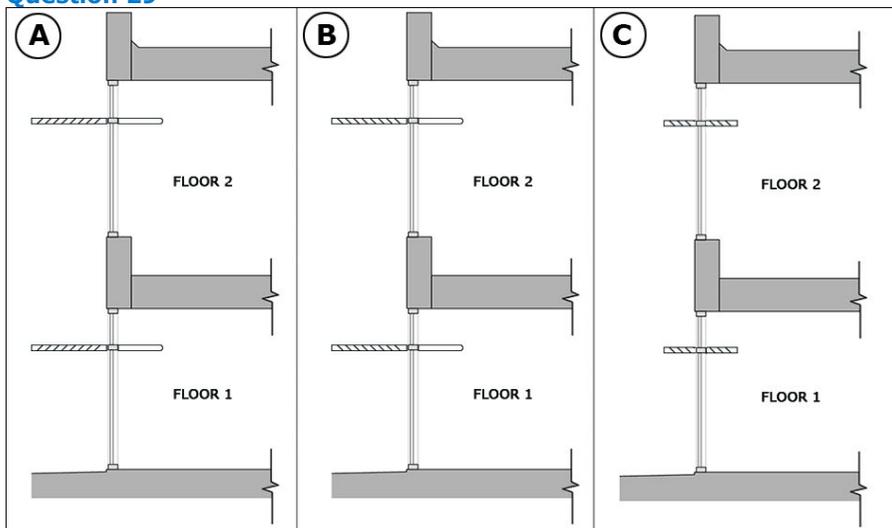
**CORRECT RESPONSES**

**B, C, E**

These doors need to swing out due to the occupancy load of the building. The remaining doors are allowed to swing in the direction shown since they do not exceed the allowable occupancy load of 50 occupants. The IBC stipulates that rooms with more than 50 occupants are required to have doors that swing in the direction of exit travel.

**Section:** Codes & Regulations

**Question 29**



Refer to the exhibit.

An architect is designing the south-facing wall section of an office building. The architect needs to provide glare control and maximize indirect daylight in the space.

Which wall section above meets the requirements?

- A. A
- B. B
- C. C

**Correct answer:** A

**CORRECT RESPONSE**

**A**

A light shelf should be placed to the right of the mullions in the interior to reflect sunlight along the ceiling, providing indirect illumination deeper into the space. Louvers running perpendicular to direct sunlight should be placed to the left of the same mullions on the outside in order to provide glare control and shading during summer months.

**Section:** Project Integration of Program & Systems

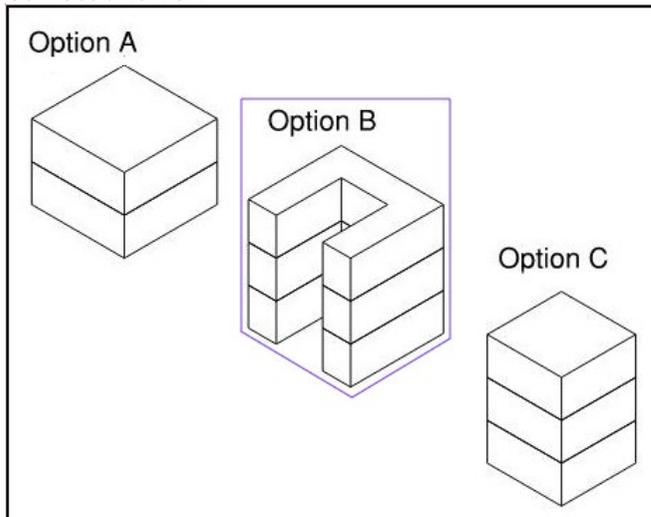
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**Question 30**

An architecture firm is evaluating design options for a new office building that will maximize the use of natural daylighting. All floor-to-floor heights and overall square footages are the same for each option.

Click on the building form option in the array that the architect should use for the design of the new office building.

**Correct answer:**



**CORRECT RESPONSE**

**Option B**

Option B has the highest ratio of surface facade area to building area.

**Section:** Project Integration of Program & Systems

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**Question 31**

A municipality hires an architect to design a public park in an environmentally sensitive area. The architect is designing a pedestrian pathway and wants to specify a material that maximizes infiltration.

Which material should the architect specify?

- A. Grass
- B. Asphalt
- C. Crushed stone
- D. Concrete pavers

**Correct answer:** C

**CORRECT RESPONSE**

**Crushed stone**

Crushed stone supports pathway traffic and also allows rainwater to filter through the material, percolating into the subsoil or running off into the lawn area or plant bedding areas.

**Section:** Environmental Conditions & Context

**Question 32**

**TABLE 601  
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)**

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V		
	A	B	A	B	A	B	A	B	C	HT	A	B	
Primary structural frame <sup>f</sup> (see Section 202)	3 <sup>a,b</sup>	2 <sup>a,b,c</sup>	1 <sup>b,c</sup>	0 <sup>c</sup>	1 <sup>b,c</sup>	0	3 <sup>a</sup>	2 <sup>a</sup>	2 <sup>a</sup>		HT	1 <sup>b,c</sup>	0
Bearing walls													
Exterior <sup>a,f</sup>	3	2	1	0	2	2	3	2	2	2		1	0
Interior	3 <sup>a</sup>	2 <sup>a</sup>	1	0	1	0	3	2	2	1/HT <sup>g</sup>		1	0
Nonbearing walls and partitions													
Exterior	See Table 705.5												
Interior <sup>d</sup>	0	0	0	0	0	0	0	0	0	See Section 2304.11.2		0	0
Floor construction and associated secondary structural members (see Section 202)	2	2	1	0	1	0	2	2	2		HT	1	0
Roof construction and associated secondary structural members (see Section 202)	1 1/2 <sup>b</sup>	1 <sup>b,c</sup>	1 <sup>b,c</sup>	0 <sup>c</sup>	1 <sup>b,c</sup>	0	1 1/2	1	1		HT	1 <sup>b,c</sup>	0

For SI: 1 foot = 304.8 mm.  
a. Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.  
b. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members in roof construction shall not be required, including protection of primary structural frame members, roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.  
c. In all occupancies, heavy timber complying with Section 2304.11 shall be allowed for roof construction, including primary structural frame members, where a 1-hour or less fire-resistance rating is required.  
d. Not less than the fire-resistance rating required by other sections of this code.  
e. Not less than the fire-resistance rating based on fire separation distance (see Table 705.5).  
f. Not less than the fire-resistance rating as referenced in Section 704.10.  
g. Heavy timber bearing walls supporting more than two floors or more than a floor and a roof shall have a fire resistance rating of not less than 1 hour.

Refer to the exhibit.

An architect is determining the fire-resistance rating of structural components for a theater with two levels of seating. The construction type is I-A, and the roof is 35 feet above the highest level of seating.

How many hours should the roof structure be rated?

- A. 0
- B. 1 1/2
- C. 1

**Correct answer:** A

**CORRECT RESPONSE**

**0**

According to footnote "b" for an assembly space, any roof construction where all components are more than 20 feet above any floor immediately below does not need to be rated.

**Section:** Codes & Regulations

**Question 33**

An architect is in the programming phase of a tenant improvement project for a small university office suite in an existing building. The client has asked for five 120-square-foot offices for staff members, a 200-square-foot conference room, and a 100-square-foot storage room. The client has a limited budget and would like to minimize the area to be remodeled.

Other programming requirements follow:

- Use a building efficiency ratio (net-to-gross) of 0.75 if a double-loaded corridor design is implemented.
- Use a building efficiency ratio (net-to-gross) of 0.70 if a single-loaded corridor design is implemented.
- At least two offices and conference rooms should be located along exterior walls for views.
- The dimension of the longest length of existing space to remodel is 50 feet.

How much area is needed for the renovation?

- A. 1,285 square feet
- B. 1,200 square feet
- C. 1,250 square feet

D. 1,575 square feet

**Correct answer: B**

**CORRECT RESPONSE**  
**1,200 square feet**

A double-loaded corridor design should be implemented to minimize the area that needs to be remodeled.

**CALCULATIONS**

1. Total office area: 120 sf x 5 offices = 600 sf
2. Total net square footage: 600 sf (offices) + 200 sf (conference room) + 100 sf (storage room) = 900 nsf
3. Gross square footage needed: 900 net sf ÷ 0.75 efficiency ratio = 1,200 sf

**Section:** Project Integration of Program & Systems

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**Question 34**

An architect is designing a pedestrian pathway in a public park. The pathway needs to be low maintenance and have the durability to withstand frequent use.

What material should the architect specify?

- A. Asphalt
- B. Grass
- C. Mulched bark
- D. Wood decking

**Correct answer: A**

**CORRECT RESPONSE**

**Asphalt**

This material offers a durable and low-maintenance surface that can withstand frequent use.

**Section:** Environmental Conditions & Context

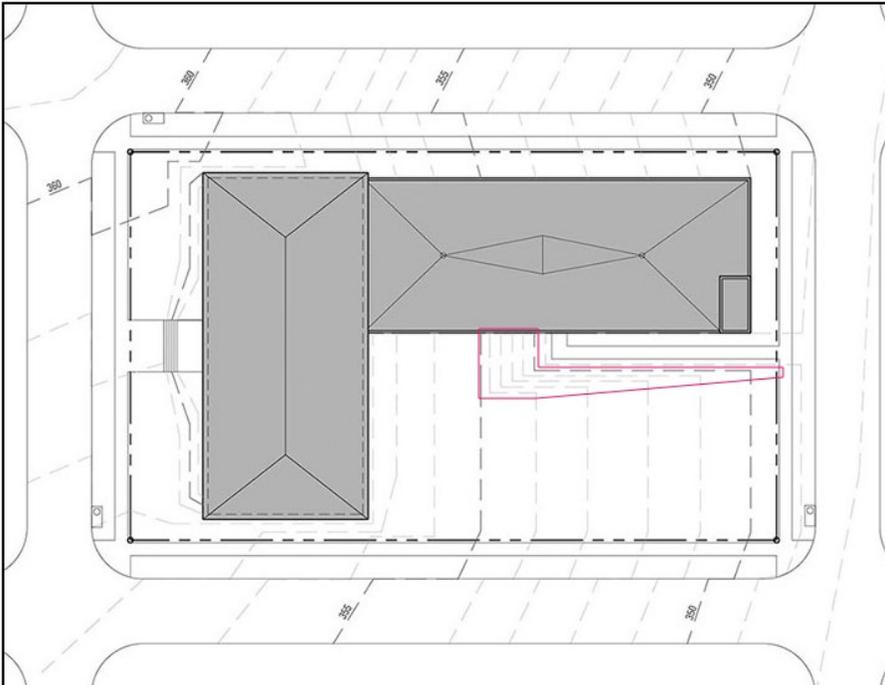
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**Question 35**

Click on the area of the site plan that is most likely to require soil stabilization.

**Your answer:** incorrect (not shown here)

**Correct answer:**



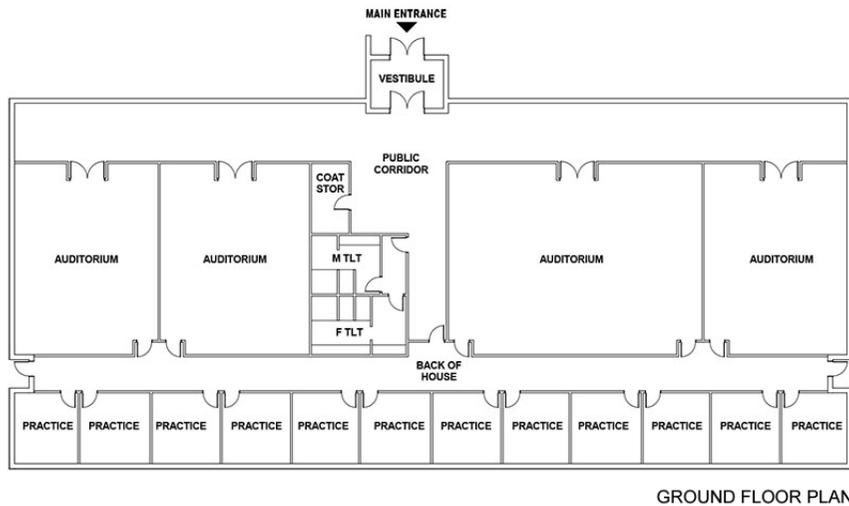
**CORRECT RESPONSE**

**Area adjacent to building and walkway**

Soil reinforcement reduces erosion on steep surfaces. This area is steeply sloping and adjacent to the building and walkway. Reinforcement should be provided to reduce soil washing onto the sidewalk.

**Section:** Project Integration of Program & Systems

**Question 36**

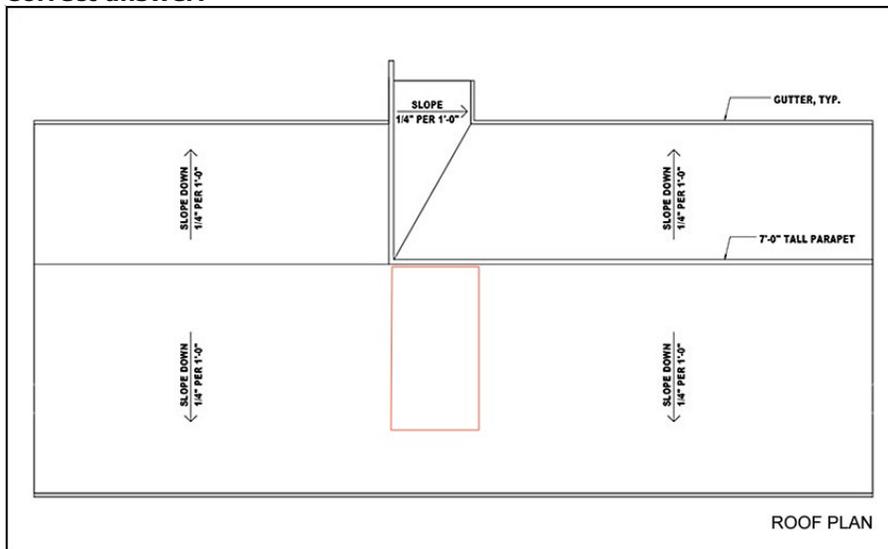


Refer to the exhibit.

An architect is designing a new music school with a focus on excellent acoustics. A new 8' x 4' x 4' air handling unit is to be located on the roof. The air handling unit should not be visible from the main entrance and should minimize unfavorable vibrations and noise to the spaces below.

Click on the area of the roof plan to indicate the most appropriate location for the air handling unit.

**Correct answer:**



**CORRECT RESPONSE**

**Behind parapet and above corridors and toilets between auditoriums**

The air handling unit should sit above a space that is not utilized for music practice or performance. The most appropriate location for the air handling unit then is just behind the parapet, above the toilets and corridor system.

**Section:** Project Integration of Program & Systems

**Question 37**

An architect is designing a mixed-use building on a sloped site. The building will have a cast-in-place concrete parking garage on the ground floor and residential units above. During the schematic design phase, the client

decides to add a level of parking below grade to the garage.

What should the architect evaluate before proceeding with the change? **Check the four that apply.**

- A. Ventilation requirements
- B. Cost of excavation
- C. Facade budget
- D. Prevailing wind direction
- E. Number of exits provided
- F. Subsoil conditions

**Correct answer:** ABEF

**CORRECT RESPONSES**

**Ventilation requirements**

An open parking garage has a minimum required opening-to-wall area ratio on each tier of the garage. Extending the garage below grade will impact the ability to provide adequate openings.

**Cost of excavation**

Adding a below grade level to the parking garage will add excavation costs to the project. The architect should notify the client that the project budget needs to be updated because of the design change.

**Number of exits provided**

Adding a story to the building requires the architect to confirm life safety requirements for the newly created spaces. The number of exits provided will be part of the life safety check.

**Subsoil conditions**

Soil conditions for the underground parking garage will impact the design of the building.

**Section:** Project Integration of Program & Systems

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**Question 38**

A client asks an architect to perform a feasibility study for a rectangular 50' x 100' urban lot. The 50' side fronts the street. The zoning ordinance stipulates the following:

- Front and side setbacks: 5'
- Rear setback: 25'
- Maximum impervious coverage: 2,400 sf
- FAR: 2.0 (based on total land area, including setbacks)
- Maximum building stories on site: 4

What is the maximum gross building area?

- A. 5,600 square feet
- B. 9,600 square feet
- C. 10,000 square feet
- D. 11,200 square feet

**Correct answer:** B

**CORRECT RESPONSE**

**9,600 square feet**

**CALCULATIONS**

1. Front and rear setbacks: 100 feet - 5 feet - 25 feet = 70 feet
2. Side setbacks: 50 feet - 5 feet - 5 feet = 40 feet
3. Buildable site area within setbacks: 40 feet x 70 feet = 2,800 square feet
4. Maximum impervious coverage is 2,400 square feet so this becomes the footprint's limiting factor.
5. Calculate maximum FAR: 50 feet x 100 feet = 5,000 square feet (total land area) x 2 (FAR) = 10,000 square feet
6. Maximum gross floor area: 2,400 square feet (max. impervious coverage) x 4 stories = 9,600 square feet (which is under the maximum FAR)

**Section:** Codes & Regulations

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**Question 39**

A two-story office building is being constructed in the southeastern United States. The architect is seeking a design strategy to maximize daylighting while minimizing heat gain.

Which strategy should the architect choose?

- A. Provide windows mounted low on the wall.
- B. Provide a larger window glass area.
- C. Provide light shelves at windows.

**Correct answer: C**

**CORRECT RESPONSE**

**Provide light shelves at windows.**

Light shelves project daylighting further into the interior spaces while at the same time shading the window area below, reducing heat gain.

**Section:** Project Integration of Program & Systems

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**Question 40**

An architect is adding a set of stairs from grade to the top landing of an existing ramp. Excluding all landings, the existing ramp is 28-feet-long and has a 1:16 slope. A survey shows no changes in grade on the site around the building. Each riser must be no more than six inches high.

How many risers should the set of stairs include?

- A. 3 risers
- B. 4 risers
- C. 5 risers

**Correct answer: B**

**CORRECT RESPONSE**

**4 risers**

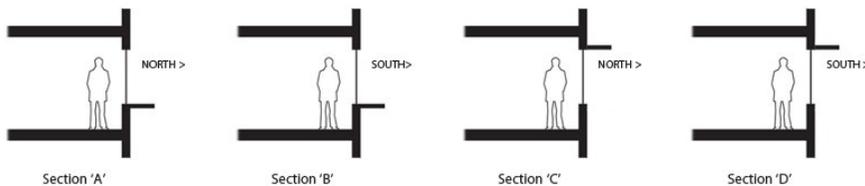
**CALCULATIONS**

1. Calculate total length of ramp in inches: 28 feet (length of ramp) x 12 inches = 336 inches
2. Calculate rise of ramp in inches: 336 inches / 16 = 21 inches of rise
3. Calculate the number of risers: 21 inches / 6 inches (max riser height) = 3.5 risers, round up to 4 risers

**Section:** Codes & Regulations

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**Question 41**



Refer to the exhibit.

An architect is designing an art studio located in the Southwest. For the interior and window configuration, the architect wants to use a wall section that allows as much daylight into the interior as possible without increasing heat gain.

Which proposed wall section should the architect select?

- A. Section A
- B. Section B
- C. Section C
- D. Section D

**Correct answer: A**

**CORRECT RESPONSE**

**Section A**

Windows facing north will admit daylight but will not receive direct sunlight into the space. The lightshelf at the sill will reflect light upward into the space.

**Section:** Project Integration of Program & Systems

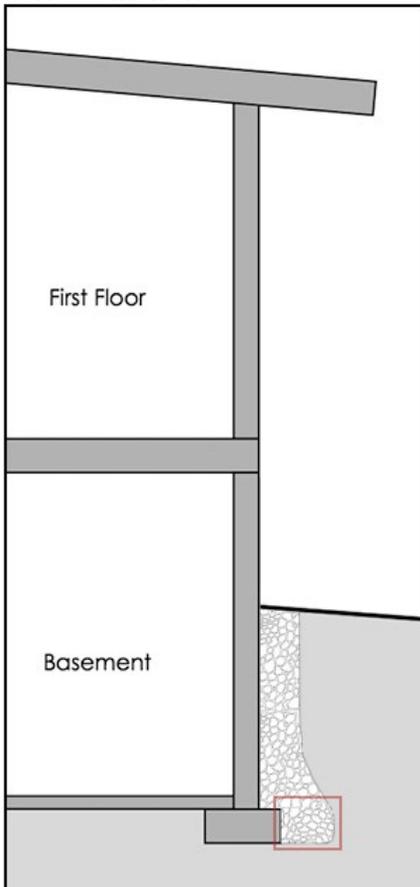
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**Question 42**

An architect is designing a perimeter stormwater management system for a residential building.

Click on the area of the building section where perforated drain pipe must be installed to divert water away from the building.

**Correct answer:**



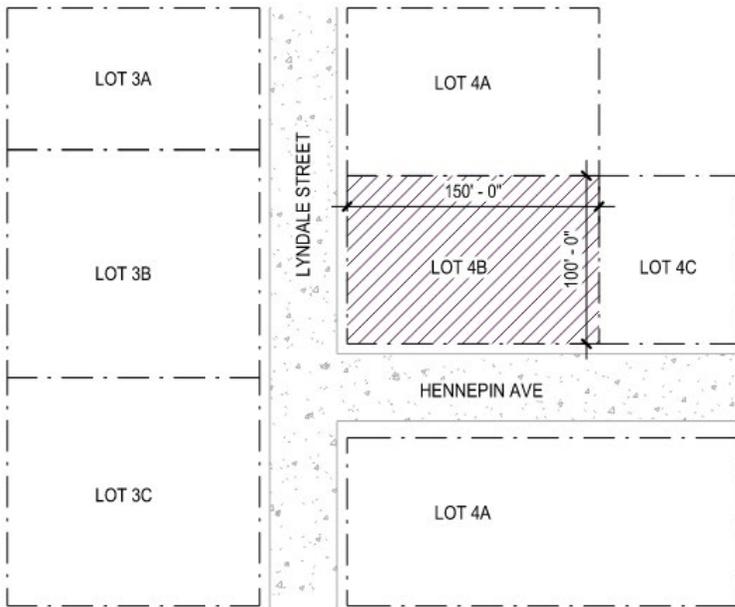
**CORRECT RESPONSE**

The perforated drain pipe is installed along the perimeter of the foundation and collects excess water and diverts it away from the building.

**Section:** Building Systems, Materials, & Assemblies

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**Question 43**



Refer to the exhibit.

A developer is determining the best building configuration for Lot 4B, a suburban plot in a cold climate. The lot is 150' x 100' and the maximum building footprint is 15,000 square feet. The owner's program requires a minimum of 48,500 square feet of office space.

To minimize heat loss in winter, which one of the following building configurations should the architect recommend?

- A. A three-story 150' x 110' rectangular footprint
- B. A four-story 120' x 120' square footprint
- C. A four-story 120' x 100' rectangular footprint
- D. A six-story 90' x 90' square footprint

**Correct answer: D**

**CORRECT RESPONSE**

**A six-story 90' x 90' square footprint**

A compact square design is most appropriate for a cold climate. This floor and area calculation fits within the allowable building footprint and meets the owner's program requirements for minimum square footage.

**CALCULATIONS**

1. 90' x 90' x 6 floors = 48,600 sf
2. 90' x 90' fits within the 150' x 100' building footprint.

**Section: Project Integration of Program & Systems**

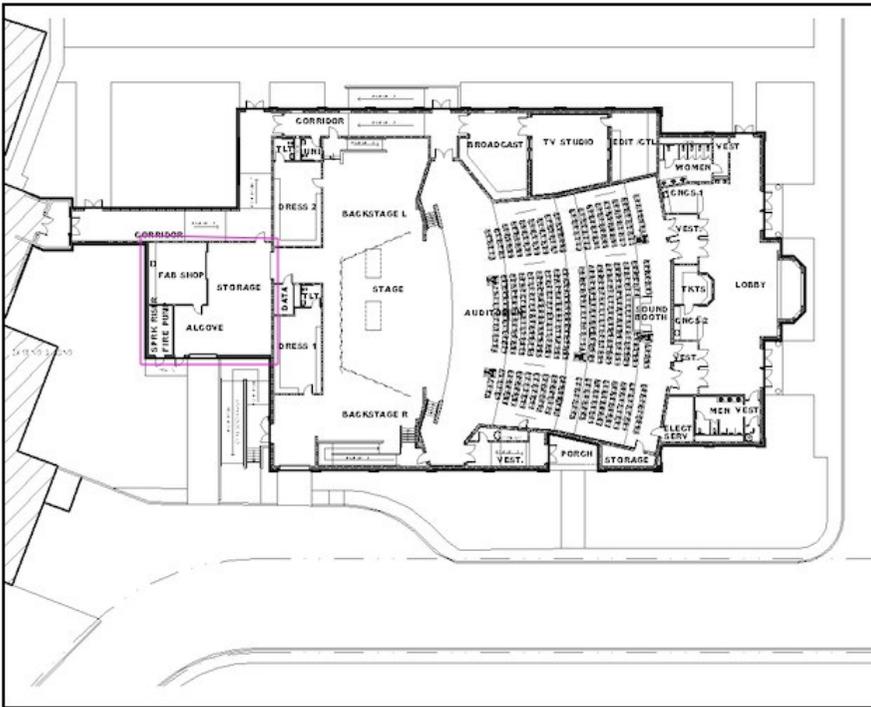
**Question 44**

Late in the DD phase for a new theater project, the owner asks to change the Auditorium's proposed flat roof assembly to a 5:12 pitch standing seam metal roof. The change requires relocating the packaged rooftop HVAC equipment. The architect must consider the following client priorities when evaluating locations:

- Minimize mechanical noise transmission in the Auditorium.
- Reserve maximum buildable area above the Stage for fly loft and set equipment.
- Conceal rooftop equipment from view at Lobby entrances.

Assuming a 24-inch-high parapet at all flat roofs, click on the area of the plan to indicate the most appropriate location for the rooftop HVAC equipment.

**Correct answer:**



**CORRECT RESPONSE**

**Above the Storage, Fab Shop, and Alcove area**

This area allows for a flat roof with parapet for ease of installation of the packaged rooftop HVAC units, which can serve the Auditorium through the wall of the higher fly loft space above the Stage. This area is also concealed from the lobby entrances, and it would minimize noise transmission into the Auditorium.

**Section:** Project Integration of Program & Systems

**Question 45**

An architect is designing a new computer lab as part of an addition to an existing high school. The owner has the following requirements:

- The lab must accommodate 30 computer workstations.
- Flexibility to switch between group and individual learning furniture configurations.
- The design should minimize sound levels within the space.

Which design should the architect consider?

- A. Raised accessible subfloor with carpet flooring
- B. Underfloor duct raceways with resilient flooring
- C. Evenly spaced floor boxes with acoustic wall panels

**Correct answer:** A

**CORRECT RESPONSE**

**Raised accessible subfloor with carpet flooring**

A raised floor will best accommodate the flexibility needed for different furniture configurations, and carpet has a good noise reduction coefficient that will help reduce overall noise reverberation in the room.

**Section:** Project Integration of Program & Systems

**Question 46**

A low-rise building is designed to allow for a future addition that will result in a midrise building with a higher water demand. When the addition is complete, the majority of the building's rooftop will be dedicated to the mechanical system and individual floors will not be able to support a water tank.

Which water supply system should be used?

- A. Upfeed distribution
- B. Downfeed distribution

C. Pumped upfeed distribution

**Correct answer: C**

**CORRECT RESPONSE**

**Pumped upfeed distribution**

Pumped upfeed distribution uses multiple pumps to supply water directly to fixtures without using a water storage tank.

**Section:** Building Systems, Materials, & Assemblies

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**Question 47**

The preliminary bids for a 40,000-square-foot high school addition are over budget. The polished concrete floor originally specified for the floor assembly costs \$6 per square foot. The owner requests a seamless flooring product and the contractor suggests the following alternative flooring materials:

- Vinyl composition tile (VCT): \$1.50 per square foot
- Luxury vinyl tile (LVT): \$4.50 per square foot
- Epoxy flooring: \$1.75 per square foot

What are the cost savings of switching to the preferred alternative flooring material?

- A. \$60,000
- B. \$170,000
- C. \$180,000

**Correct answer: B**

**CORRECT RESPONSE**

**\$170,000**

The owner wants a seamless flooring product and the epoxy flooring is the only option that meets this requirement.

**CALCULATIONS**

1. Cost of the originally specified polished concrete flooring material:  $\$6.00 \times 40,000 \text{ sf} = \$240,000$
2. Cost of the preferred alternative flooring material, epoxy flooring:  $\$1.75 \times 40,000 \text{ sf} = \$70,000$
3. Cost savings of switching flooring material:  $\$240,000 - \$70,000 = \$170,000$

**Section:** Project Costs & Budgeting

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**Question 48**

An architect is designing a children's playground in a residential development. The playground site is an open grass area that is prone to ponding rain water. The developer has asked the architect to reduce the ponding without regrading.

Which one of the following should the architect include in the playground design?

- A. Area drains
- B. Slotted concrete pavers
- C. Subsurface perforated piping
- D. Brick pavers with open joints

**Correct answer: C**

**CORRECT RESPONSE**

**Subsurface perforated piping**

Subsurface perforated piping is used to control and remove soil moisture.

**Section:** Building Systems, Materials, & Assemblies

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**Question 49**

An architect is designing a building renovation and needs to add an accessible ramp at an existing entrance that currently only has stairs. The dimension between grade and the building entrance is 42". A survey shows no changes in grade on the site around the building. Accessibility code requires wheelchair accessible ramps to be between a 1:12 and 1:20 slope, with a maximum rise of 30" between 60"-long landings.

Based on the accessibility code requirements provided above, what is the minimum length of the accessible ramp between the top and bottom landings?

- A. 30'-0"
- B. 42'-0"
- C. 47'-0"
- D. 75'-0"

**Correct answer: C**

**CORRECT RESPONSE**  
**47'-0"**

**CALCULATIONS**

1. The ramp has a maximum rise of 30 inches at a 1:12 slope, so one intermediate landing of 60 inches (minimum) is required = 5 feet
2. Minimum ramp length: 42 inches of vertical rise requires 42 feet of ramp
3. 42 feet of ramp + 5 feet for the intermediate landing = 47 feet

**Section:** Codes & Regulations

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**Question 50**

A first-time developer purchases an undeveloped agricultural parcel for a new residential development. The developer asks the architect for guidance on which regulatory bodies and processes the developer must engage with initially.

What should the architect's guidance to the developer include? **Check the three that apply.**

- A. Schedule an historic preservation review
- B. Obtain zoning approval
- C. Record plats with the AHJ
- D. Comply with ADA standards
- E. Seek permission to subdivide
- F. Complete Fair Housing Act review

**Correct answer: BCE**

**CORRECT RESPONSES**

**Obtain zoning approval**

Zoning approval will confirm the planned use of the land and the density of the proposed development.

**Record plats with the AHJ**

Once final site approval is given, plats are recorded in government files and individual lots can be sold.

**Seek permission to subdivide**

Agricultural parcels are large pieces of land that are then subdivided into individual lots for resale. Plans are made for shared amenities, such as roads, and for bringing utilities within reach of each lot.

**Section:** Codes & Regulations

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**Question 51**

An architect is designing a single-family house in a climate with cold winters and temperate summers. The client asks the architect to add an outdoor patio to the house for daily use and for family gatherings.

What is the most appropriate patio configuration?

- A. South-facing and using deciduous trees and low coniferous hedges to provide shelter from the wind.
- B. East-facing and using coniferous trees to provide shelter from the wind.
- C. North-facing and using the building to provide shelter from the wind.
- D. West-facing and using coniferous trees to provide shelter from the wind.

**Correct answer: A**

**CORRECT RESPONSE**

**South-facing and using deciduous trees to provide shelter from the wind.**

This is correct because in a climate with cold winters and temperate summers there will be little need to cool outdoor spaces, and a location on the sunny equatorial side of the building is prime. Low year-round windbreaks and deciduous trees allow the patio to still gain sun in the winter months.

**Section:** Project Integration of Program & Systems

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**Question 52**

An architect is designing a five-story addition to an existing building, and a separate foundation needs to be designed to support the addition. A subsurface investigation reveals that the soil on the site is predominantly coarse grained.

Which type of foundation is most appropriate for the new building?

- A. Shallow foundation with stepped footings
- B. Shallow foundation with cantilever footings
- C. Deep foundation with micropiles
- D. Deep foundation with friction piles

**Correct answer:** B

**CORRECT RESPONSE****Shallow foundation with cantilever footings**

Coarse grained soil on the site indicates that a deep foundation is not required. A cantilever footing addresses the need to build against an existing building.

**Section:** Building Systems, Materials, & Assemblies

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**Question 53**

An architect is designing a theater with a control room that will house lighting and acoustical control equipment.

Which type of portable fire extinguisher should the architect specify for this room?

- A. Class A
- B. Class B
- C. Class C
- D. Class D

**Correct answer:** C

**CORRECT RESPONSE****Class C**

Class C extinguishers are used on fires involving electrical equipment.

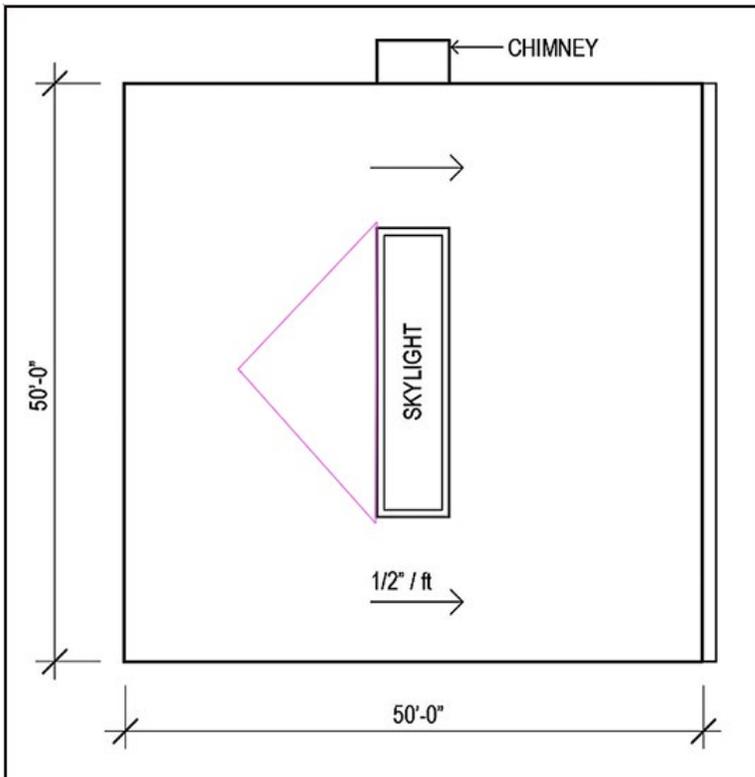
**Section:** Building Systems, Materials, & Assemblies

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**Question 54**

Click on the area of the roof plan that requires a cricket to maintain positive drainage.

**Correct answer:**



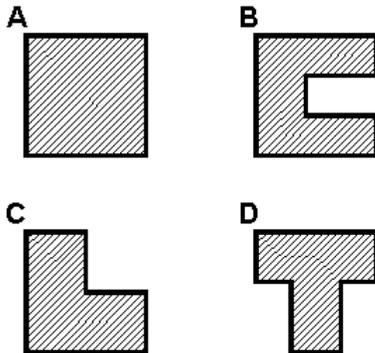
**CORRECT RESPONSE**

**Area to immediate left of Skylight**

Crickets redirect water from obstructions to the primary water flow to maintain positive drainage. The skylight in the center of the roof plan is perpendicular to the roof slope and would require a cricket.

**Section:** Project Integration of Program & Systems

**Question 55**



Refer to the exhibit.

Which one of the building shapes is most likely to resist damage from an earthquake?

- A. A
- B. B
- C. C
- D. D

**Correct answer:** A

**CORRECT RESPONSE**

**A**

Small, round, square, or rectangular shaped building geometry allows for equal resistance of lateral forces in all directions. Structures having an "L," "T," "H," "U," or "E" shape have unequal resistance that may cause the structure to pull apart in an earthquake.

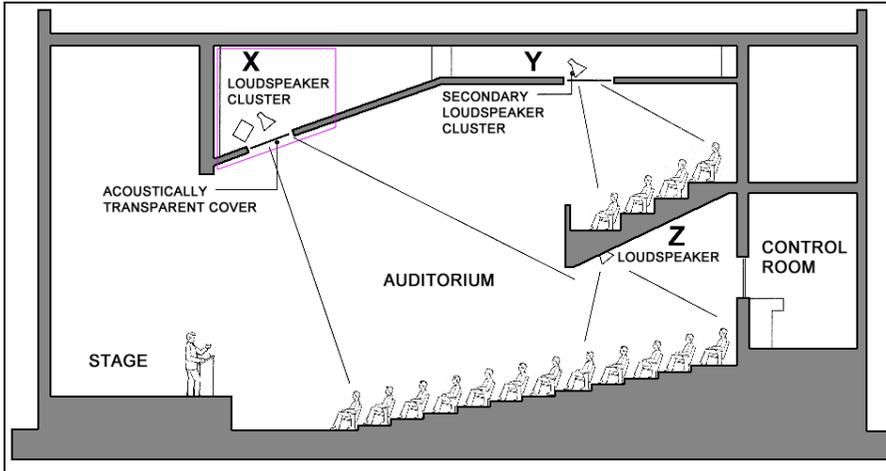
**Section:** Building Systems, Materials, & Assemblies

**Question 56**

An architect is coordinating the acoustical system for an auditorium, which is equipped with a series of loudspeakers. Some of the loudspeakers will require a time delay in order to prevent loudspeaker sound from reaching the audience before the sound of the presenter. The architect is determining which loudspeakers can function without a time delay.

Click on the loudspeaker in the section that does not require a time delay.

**Correct answer:**



**CORRECT RESPONSE**

**Loudspeaker Cluster X**

With loudspeakers located above the presenter in a central cluster system, the direct sound from the presenter will reach the listener slightly before the amplified sound. Therefore, the two sounds are fully integrated, as per the Haas effect (the sound that arrives first establishes the source of the sound (the presenter) and the second sound close behind adds to the loudness and the listener believes that the sound is from the presenter). The first loudspeaker cluster above the presenter, then, will not require a time delay. Loudspeakers Y and Z, on the other hand, will require a time delay because their locations are so far away from the presenter that the sound from those loudspeakers will reach the listeners before the sound from the presenter.

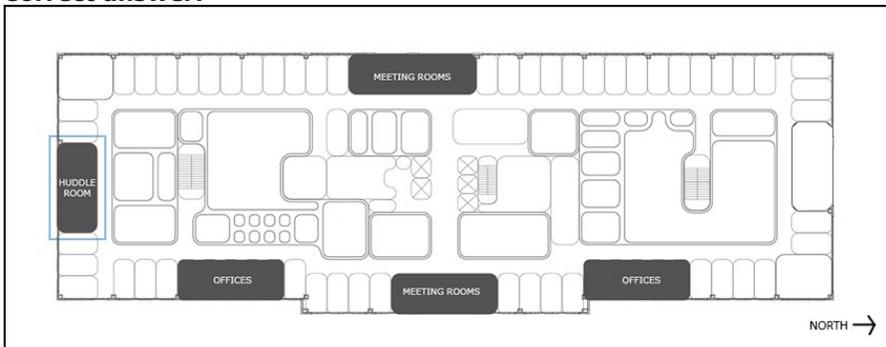
**Section:** Building Systems, Materials, & Assemblies

**Question 57**

An office building located in the upper Midwest is experiencing excessive heat in both Meeting Rooms, the Huddle Room, and both Offices during the day. The architect decides that solar heat gain needs to be reduced in these areas with shading systems.

Click on the shaded room in the floor plan where a horizontal overhang would be most effective in reducing solar heat gain.

**Correct answer:**



**CORRECT RESPONSE**

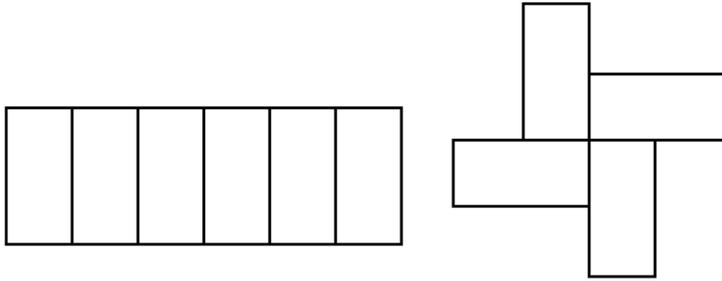
**Huddle Room**

Horizontal overhangs are most effective on southern exposures.

**Section:** Project Integration of Program & Systems

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**Question 58**



Refer to the exhibit.

In which of the following climates should row or cluster housing be used for protection against wind?

- A. Hot and humid
- B. Hot and dry
- C. Temperate
- D. Cold

**Correct answer:** D

**CORRECT RESPONSE**

**Cold**

Row or cluster housing is most appropriate for cold climates where protection from cold winter winds is a priority.

**Section:** Environmental Conditions & Context

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**Question 59**

During a preliminary code review meeting of the schematic design, the AHJ states that the city does not enforce federal accessibility standards for clear floor space around plumbing fixtures.

What action should the architect take?

- A. Decrease the area of the floor plan to save on construction costs.
- B. Design all plumbing fixtures to meet federal accessibility standards.
- C. Design half of the plumbing fixtures to meet federal accessibility standards.

**Correct answer:** B

**CORRECT RESPONSE**

**Design all plumbing fixtures to meet federal accessibility standards.**

The architect must meet federal accessibility standards regardless of AHJ enforcement.

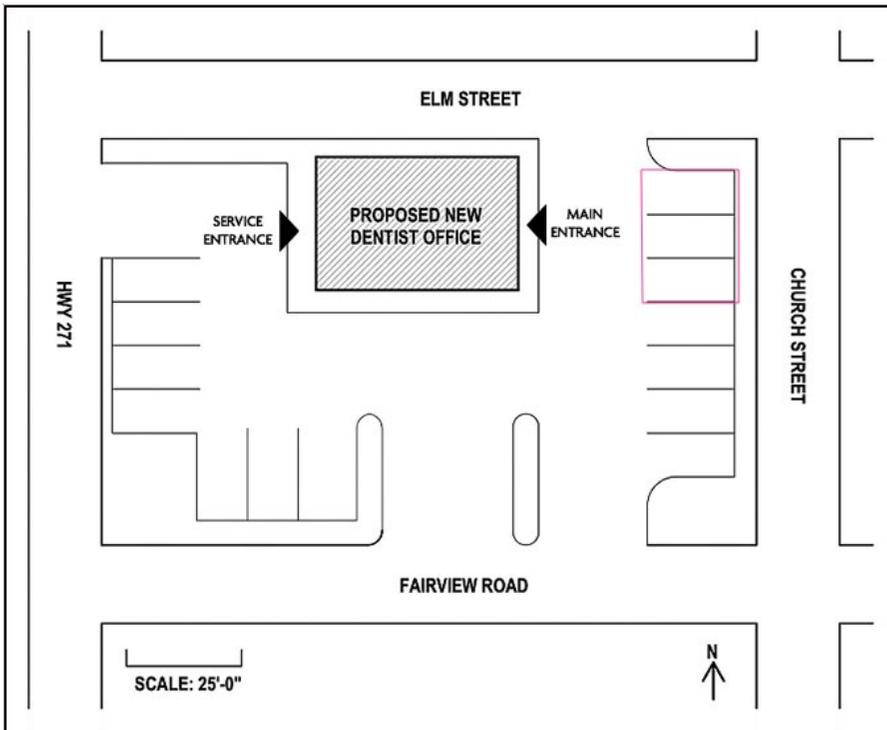
**Section:** Codes & Regulations

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**Question 60**

Click on the area of the site plan where the required ADA accessible parking spaces should be located.

**Correct answer:**



**CORRECT RESPONSE**

**The three parking spots closest to the main entrance.**

This is the correct location for the accessible parking spaces because accessible parking should be placed in those parking spaces closest to the main entrance of a building.

**Section:** Codes & Regulations

**Question 61**

A condominium project is planned with electric carts and sport court amenities. The program includes an electric cart storage garage for 36, four-foot-wide, two-passenger carts. The nine-foot-wide reinforced concrete path from the garage to the sport courts is a target for value engineering.

Which of the following are appropriate cost-saving strategies? **Check the three that apply.**

- A. Specify a compacted gravel path
- B. Utilize pervious concrete
- C. Reduce the path width to six feet and add limited widened areas for passing
- D. Modify the existing grade to reduce undulations
- E. Reduce the number of carts to be stored within the garage
- F. Redesign the path route with a more direct link to the sport courts

**Correct answer:** ACF

**CORRECT RESPONSES**

**Specify a compacted gravel path**

Compacted aggregate costs less than reinforced concrete and will support electric carts.

**Reduce the path width to six feet and add limited widened areas for passing**

At four feet wide, the carts are appropriate for a six-foot-wide path. By adding defined areas for passing, it avoids the need for carts to go off the path.

**Redesign the path route with a more direct link to the sport courts**

A more direct link will reduce overall length of pavement needed.

**Section:** Project Costs & Budgeting

**Question 62**

An architect is renovating an existing building with 10,080 sf of glazing. The architect must assess the energy cost savings of re-glazing the existing wood windows instead of installing new aluminum windows. Assume the following energy cost information:

- Anticipated energy costs are \$60,000 per year.
- There will be 20% in savings on energy costs if the windows are re-glazed.
- There will be 18% in savings on energy costs if new aluminum windows are installed.

Over a 30-year period, what is the anticipated energy cost savings of re-glazing instead of installing new aluminum windows?

- A. \$1,200
- B. \$10,800
- C. \$12,000
- D. \$36,000

**Correct answer:** D

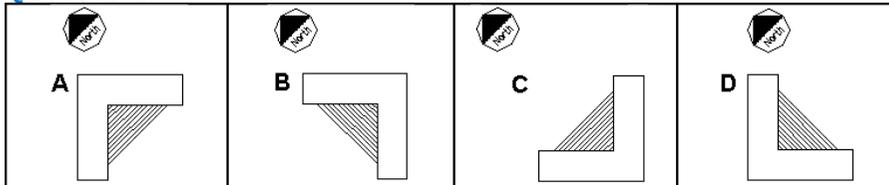
**CORRECT RESPONSE**  
\$36,000

**CALCULATIONS**

1. For the savings per year of using re-glazed units: \$60,000 (anticipated energy costs) x 20% (cost savings) = \$12,000
2. For the savings per year of using new aluminum windows: \$60,000 (anticipated energy costs) x 18% (cost savings) = \$10,800
3. Difference in yearly cost savings: \$12,000 - \$10,800 = \$1,200
4. Amount saved over 30 years: \$1,200 x 30 = \$36,000

**Section:** Project Costs & Budgeting

**Question 63**



Refer to the exhibit.

An architect is working on a seven-story L-shaped office building in the northern United States. There will be a three-story glass-enclosed atrium with masonry walls between the two wings of the building. The owner wants the walls within the atrium to have maximum solar gain in the morning only.

Which building orientation should the architect use?

- A. A
- B. B
- C. C
- D. D

**Correct answer:** D

**CORRECT RESPONSE**

**D**  
With building orientation D, the atrium faces the east, which is the best direction for receiving the maximum morning-only solar gain requested by the owner.

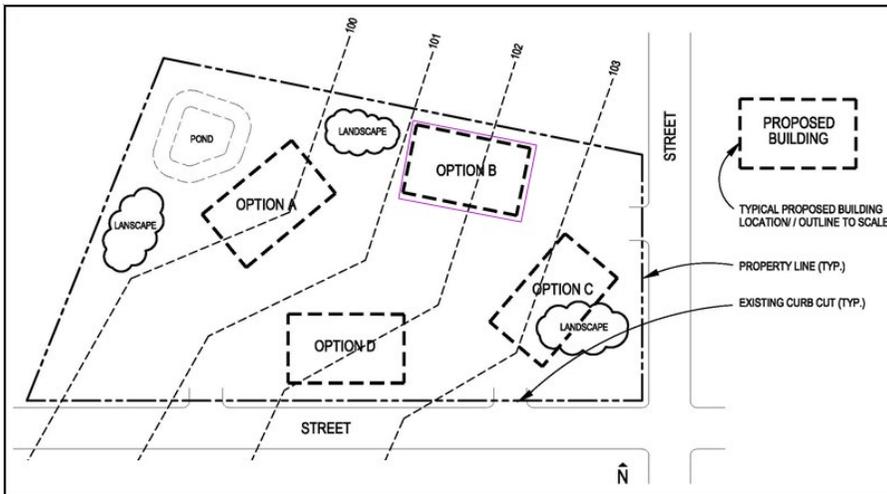
**Section:** Environmental Conditions & Context

**Question 64**

An architect is developing an existing site for an auto dealership. To save costs, the owner wants the sales and service building located in an area that maintains existing site drainage and landscaping. The owner also wants to locate vehicle inventory parking in an area with maximum visibility from traffic.

Click on the area of the site plan to indicate the most appropriate location for the sales and service building.

**Correct answer:**



**CORRECT RESPONSE**

**Option B**

Option B will not conflict with drainage and provides for a long axis to park vehicle inventory that will maximize the promotion of that inventory to passing traffic.

**Section:** Environmental Conditions & Context

**Question 65**

An architect is coordinating the design of the lighting and electrical receptacle locations for an amphitheater project. The consulting electrical engineer recommends a line voltage system over a low voltage system.

Why should the architect take the engineer's recommendation to use a line voltage system?

- A. Lower installation costs
- B. Fewer junction boxes required
- C. Easy integration of system over large areas

**Correct answer:** C

**CORRECT RESPONSE**

**Easy integration of system over large areas**

Line voltage systems have a lower voltage drop and can carry power for greater distances than low voltage systems.

**Section:** Building Systems, Materials, & Assemblies

**Question 66**

A modular wall system vendor hires an architect to design a showroom in a new high-rise building with 15' slab-to-slab levels. The vendor wants to highlight the workspace flexibility offered by their demountable wall systems. The vendor also wants a flexible electrical system without exposed cabling.

Which one of the following options is most appropriate for the showroom?

- A. Wire cable hanging system
- B. Raised access flooring system
- C. Floor-mounted raceway system

**Correct answer:** B

**CORRECT RESPONSE**

**Raised access flooring system**

A raised access flooring system will give the vendor flexibility without exposed cabling. The ample slab-to-slab height allows a raised system to integrate other systems.

**Section:** Project Integration of Program & Systems

**Question 67**

An architect is specifying replacement flooring for an open office area in an existing building. The office area features many workstations and pieces of office furniture. The owner's primary concern is to replace the flooring as quickly as possible.

Which one of the following should the architect specify?

- A. Terrazzo
- B. Carpet tile
- C. Ceramic tile
- D. Roll carpet

**Correct answer: B**

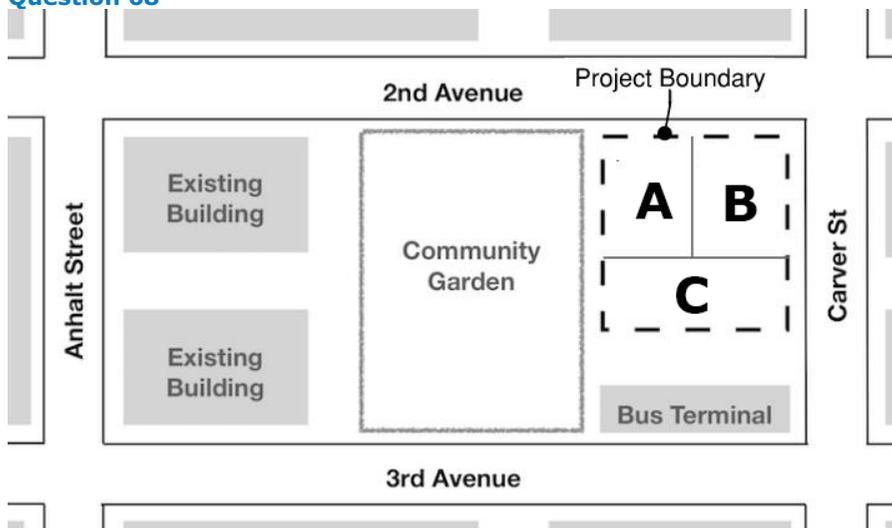
**CORRECT RESPONSE**

**Carpet tile**

Workstations can be lifted with jacks and carpet tiles can be installed underneath without having to disassemble or move existing furniture. The owner's primary concern is to replace the flooring quickly, and because disassembling and moving office furniture is time consuming, the flooring material that can be installed the most quickly is the most appropriate choice.

**Section:** Building Systems, Materials, & Assemblies

**Question 68**



Refer to the exhibit.

An architect is designing a new community center located in an historic district that consists of two-story brick veneer buildings. For new construction, the local planning department has mandated that a majority of street-facing facades maintain a similar aesthetic as the adjacent historic facades. On the interior of the city block, other facade treatments are encouraged. Program requirements for community center buildings follow:

- Exploratorium Lab (EL): Will be built using metal studs with brick veneer and limited windows.
- Outreach Center (OC): Must be located near the Community Garden with direct access to 2nd Avenue for deliveries and feature glass facades.
- Welcome Center (WC): Must be located near the Bus Terminal and Community Garden and feature glass facades.

Which letter within the project boundary above represents the appropriate location for the Outreach Center (OC)?

- A. A
- B. B
- C. C

**Correct answer: A**

**CORRECT RESPONSE**

**A**

The Outreach Center (OC) requires access from 2nd Avenue and must be near the Community Garden.

**Section:** Environmental Conditions & Context

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**Question 69**

	Product Cost Per Sq. Ft.	Product Cost Per Sq. Yd.	Installation Cost Per Sq. Ft.
Carpet		\$54.00	\$2.50
Padding	\$0.50		Included
Porcelain Tile	\$9.00		\$2.00
Cementitious Terrazzo	\$15.00		Included
Epoxy Terrazzo	\$18.00		Included
Inlaid Vinyl Sheet Flooring	\$6.00		\$2.00
LVP	\$4.00		\$2.00
Underlay	\$0.50		\$0.50

Refer to the exhibit.

A hospital considers converting a 5,000-square-foot office space into clinical space. The space is currently carpeted but will require a change to a nonporous surface. The following flooring materials are being evaluated based on their life expectancy:

- Porcelain tile: 10 years
- Epoxy terrazzo: 20 years
- Inlaid vinyl sheet: 5 years

Assuming the same replacement material is used, what is the price of the most cost-effective flooring material over a 25-year period?

- A. \$135,000
- B. \$150,000
- C. \$165,000
- D. \$180,000

**Correct answer:** C

**CORRECT RESPONSE**  
**\$165,000**

**CALCULATIONS**

Calculate the lowest cost of each material option over 25 years

1. Porcelain tile: 3 installations x \$11/sf (price + installation) = \$33
2. Epoxy terrazzo: 2 installations x \$18/sf (price + installation included) = \$36
3. Inlaid vinyl sheet: 5 installations x \$8/sf (price + installation) = \$40

Comparing the above, three installations of porcelain tile are less expensive than two installations of Epoxy terrazzo or five installations of Inlaid vinyl sheet.

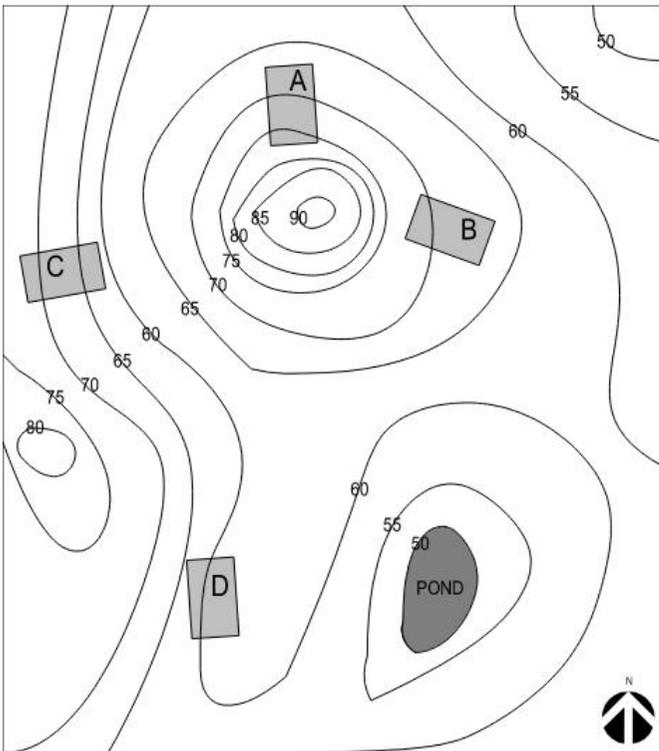
Calculate the cost of the porcelain tile over 25 years.

4. \$9.00 (price of porcelain tile per sf) + \$2.00 (installation price per sf) = \$11 per sf
5. \$11.00 x 5,000 (square footage of converted space) = \$55,000
6. \$55,000 x 3 (number of installations over 25 years) = \$165,000

**Section:** Project Costs & Budgeting

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**Question 70**



Refer to the exhibit.

An architect is designing a 30' x 50' building that must incorporate daylighting and provide views to the pond.

Which building configuration should the architect choose?

- A. Building Configuration A
- B. Building Configuration B
- C. Building Configuration C
- D. Building Configuration D

**Correct answer:** B

**CORRECT RESPONSE**  
**Building Configuration B**

This configuration is most appropriate, as it has an east-west, lengthwise orientation and provides views to the pond.

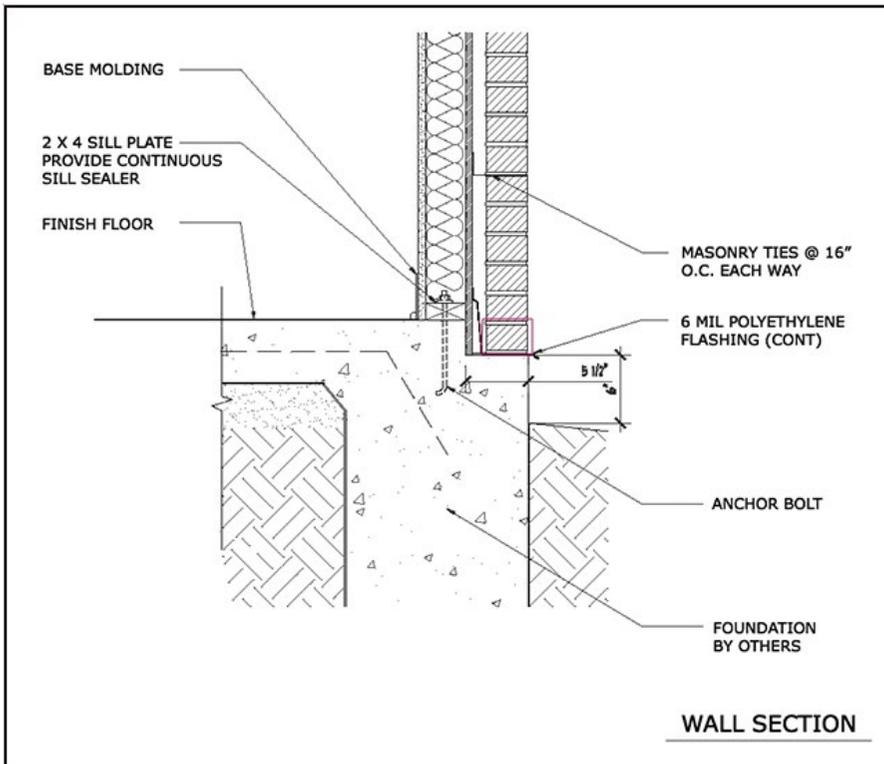
**Section:** Project Integration of Program & Systems

**Question 71**

An architect reviews a preliminary wall detail and determines that the specified weeps are not illustrated.

Click on the area of the wall section detail where the weeps should be located.

**Correct answer:**



**CORRECT RESPONSE**

**Above the 6 MIL Polyethylene Flashing**

In this wall section, weeps should be located in the brick veneer above the polyethylene flashing to allow moisture to drain from the brick cavity wall.

**Section:** Building Systems, Materials, & Assemblies

**Question 72**

An architect is designing a new 1,200-square-foot house with eight-foot ceilings. The initial design calls for five 3' x 4' windows that allow 60 cfm of fresh air each. However, the local sustainable design ordinance requires new houses to provide three fresh air changes per hour.

How many additional 3' x 4' windows are required to comply with the ordinance?

- A. 3 windows
- B. 5 windows
- C. 8 windows
- D. 11 windows

**Correct answer:** A

**CORRECT RESPONSE**

**3 windows**

**CALCULATIONS**

1. House volume: 1,200 square feet x 8 foot ceiling height = 9,600 cubic feet
2. Cubic feet per hour required by ordinance: 9,600 cubic feet x 3 fresh air changes per hour = 28,800 cubic feet per hour
3. Cubic feet per minute required: 28,800 cubic feet per hour / 60 minutes per hour = 480 cubic feet per minute
4. Cubic feet per minute provided by five windows: 5 windows x 60 cubic feet per minute = 300 cubic feet per minute
5. Cubic feet per minute deficit: 480 cubic feet per minute required - 300 cubic feet per minute already available = 180 cubic feet per minute still needed
6. Additional windows required: 180 cubic feet per minute / 60 cubic feet per minute (each window) = 3 windows

**Section:** Project Integration of Program & Systems

**Question 73**

An architect is designing a car dealership that is surrounded by residential property on all sides. The owners of the residences are concerned about the impact of the dealership on the neighborhood. The owner of the dealership wants to deter complaints.

Which of the following should the architect consider within the design to limit nuisance complaints? **Check the four that apply.**

- A. Staff office locations within building
- B. Vehicle repair and operation noise
- C. Public transportation noise
- D. Site landscaping
- E. Vehicle parking
- F. Site lighting

**Correct answer:** BDEF

**CORRECT RESPONSES**

**Vehicle repair and operation noise**

Without a proper buffer, these noises could disturb the neighbors.

**Site landscaping**

Appropriate site landscaping can help with site drainage, privacy, and noise reduction.

**Vehicle parking**

Without a proper buffer, this could be a visual blight to the neighborhood.

**Site lighting**

Fixtures that are not cutoff may cast light onto neighboring property.

**Section:** Environmental Conditions & Context

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**Question 74**

An architect is specifying a geo-exchange heat pump system for an office building. The building is on a site that has a significant concentration of groundwater and is conducive to well drilling. The owner wants the heat pump system that is the most cost-effective and energy-efficient.

Which heat pump system should the architect specify?

- A. Vertical open loop
- B. Vertical closed loop
- C. Horizontal open loop
- D. Horizontal closed loop

**Correct answer:** B

**CORRECT RESPONSE**

**Vertical closed loop**

For ground that is conducive to well drilling, the deep ground will be warmer in the winter and cooler in the summer than ground closer to the surface. Vertical systems are most efficient in ground that is conducive to well drilling. Closed loop systems use much less pumping energy than open loop systems.

**Section:** Building Systems, Materials, & Assemblies

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### Question 75

An architect is designing a replacement roofing system for an existing building in a hospital complex. The hospital is worried about the effects of the installation of the roof on patients with breathing difficulties. The hospital has asked the architect to choose a roofing system that minimizes health risks.

Which roofing system should the architect specify?

- A. EPDM
- B. Modified bitumen
- C. Four-ply built-up roof

**Correct answer:** A

#### **CORRECT RESPONSE** **EPDM**

EPDM membranes have a minimal amount of seams which are joined together with adhesive. This roofing system is the most appropriate option because it is the only system that will not pose a risk to the health of hospital patients during its installation.

**Section:** Building Systems, Materials, & Assemblies

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### Question 76

What is the most appropriate drainage system component for collecting runoff at the bottom of a parking deck ramp?

- A. Drop inlet
- B. Catch basin
- C. Trench drain

**Correct answer:** C

#### **CORRECT RESPONSE** **Trench drain**

This drain type is used along the bottom of steps, ramps, driveways, and other surfaces to collect and drain surface water.

**Section:** Building Systems, Materials, & Assemblies

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### Question 77

A client is considering changes to the site development schedule for a new parking lot and public plaza by delaying the project start for a year.

Click on the line item in the cost estimate that will need to be adjusted due to this change.

**Correct answer:**

	Quantity	Unit Cost	Unit Measure	Total
<b>Site Work</b>				
Site Prep. and Rough Grading	940,460	\$0.68	Sq. Ft. Surface	\$641,864.00
Fine Grading	47,301	\$2.32	Sq. Ft. Surface	\$109,762.00
Asphalt Paving	1,230	\$1,147.50	Per Car	\$1,411,425.00
Plaza Pavers	2,000	\$19.59	Sq. Ft. Surface	\$39,186.00
Utility Relocation	940,460	\$2.73	Sq. Ft. Surface	\$2,567,456.00
Planting Allowance	42,570	\$0.92	Sq. Ft. Surface	\$39,335.00
Site Fencing	4,000	\$17.99	Lin. Feet	\$71,946.00
Security Booth	1	\$15,000.00	Each	\$15,000.00
<b>Subtotal Cost</b>				\$4,895,974.00
Contractor OH & Profit		7	Percent	\$342,652.80
Design Contingency		7	Percent	\$366,703.88
Escalation		3	Percent	\$168,159.92
<b>Adjusted Total Construction Cost</b>				\$5,773,490.60

**CORRECT RESPONSE**

**Escalation**

Delaying the project for a year will impact the project budget, and an adjustment will need to be made to the "Escalation" line item, which accounts for inflation.

**Section:** Project Costs & Budgeting

**Question 78**

A church congregation hires an architect to help them determine the feasibility of converting a retail strip mall space into a church. The space is 30'-wide and 125'-long and is in an interior location with tenants on both sides. The church congregation requests the following:

- Natural light in the central assembly space
- Nursery space for young children
- Church office space
- Adequate restrooms

How should the architect initially determine the feasibility of the project for the purpose of building code compliance?

- A. Analyze the existing building exits and evaluate their adequacy for the new use classification.
- B. Analyze the existing roof structure to determine the potential locations for skylights.
- C. Analyze the existing parking to determine its adequacy for the new use classification.

**Correct answer:** A

**CORRECT RESPONSE**

**Analyze the existing building exits and evaluate their adequacy for the new use classification.**

Life safety is the first charge of the architect.

**Section:** Project Integration of Program & Systems

**Question 79**

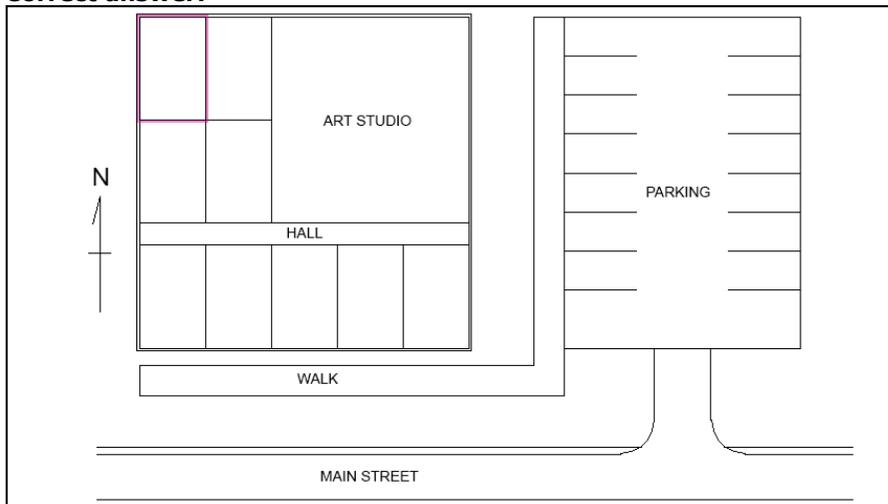
An architect is designing a cooperative Art Studio and needs to select a space for the Mechanical Room based on the following requirements:

- Should vent to the north.
- Should not face Main Street.

- Should have an exterior exposure.
- Should not be adjacent to the Art Studio.

Click on the space in the plan where the Mechanical Room should be located.

**Correct answer:**



**CORRECT RESPONSE**

**Space in northwest corner**

The Mechanical Room should be located in this space because it vents to the north, is located far from Main Street, is not adjacent to the Art Studio, and has an exterior exposure.

**Section:** Project Integration of Program & Systems

**Question 80**

An architect is selecting an elevator for a three-story residential building that serves 12 apartments. Initial cost is the developer's primary consideration.

Which one of the following systems should the architect select?

- A. Geared traction elevator
- B. Gearless traction elevator
- C. Holeless hydraulic elevator
- D. Conventional hydraulic elevator

**Correct answer: C**

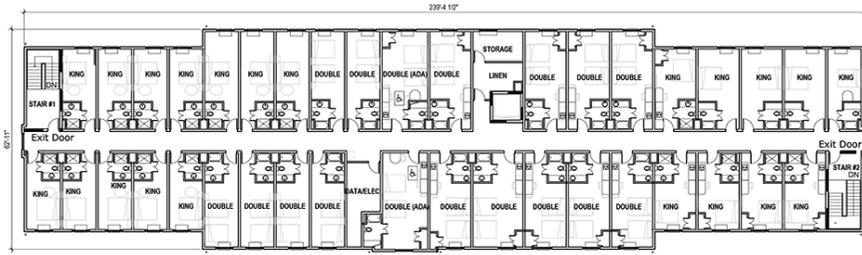
**CORRECT RESPONSE**

**Holeless hydraulic elevator**

Holeless hydraulic elevators can serve lift heights up to 40 feet so it will work for a three-story building. While a holeless hydraulic elevator will have higher operating costs, it will have the lowest initial cost, which is what the developer desires.

**Section:** Building Systems, Materials, & Assemblies

**Question 81**



**1 PLAN** THIRD FLOOR PLAN  
1/16" = 1'-0"

Refer to the exhibit.

An architect is designing a four-story hotel with a double-loaded corridor system where exit stairs are located at each end of the corridor. Exit stair shafts are considered safe areas inside the building. The owner wants exit doors on each floor to be held in an open position and equipped with automatic door closing devices.

Which hold open doors must return to the close position when the fire alarm is triggered?

- A. Exit doors located on the floor where a fire originates.
- B. Exit doors leading to the exit stair shaft on all of the floors.
- C. Exit doors to stair shafts located at all floors above the floor where a fire originates.

**Correct answer: B**

**CORRECT RESPONSE**

**Exit doors leading to the exit stair shaft on all of the floors.**

Stair shafts are considered safe zones inside the building and must be free from smoke and fire during an emergency.

**Section: Codes & Regulations**

**Question 82**

[F]TABLE 509.1  
INCIDENTAL USES

ROOM OR AREA	SEPARATION AND/OR PROTECTION
Furnace room where any piece of equipment is over 400,000 Btu per hour input	1 hour or provide automatic sprinkler system
Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower	1 hour or provide automatic sprinkler system
Refrigerant machinery room	1 hour or provide automatic sprinkler system
Hydrogen fuel gas rooms, not classified as Group H	1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E, I and R occupancies.
Incinerator rooms	2 hours and provide automatic sprinkler system
Paint shops, not classified as Group H, located in occupancies other than Group F	2 hours; or 1 hour and provide automatic sprinkler system
In Group E occupancies, laboratories and vocational shops not classified as Group H	1 hour or provide automatic sprinkler system
In Group I-2 occupancies, laboratories not classified as Group H	1 hour and provide automatic sprinkler system
In ambulatory care facilities, laboratories not classified as Group H	1 hour or provide automatic sprinkler system
Laundry rooms over 100 square feet	1 hour or provide automatic sprinkler system
In Group I-2, laundry rooms over 100 square feet	1 hour
Group I-3 cells and Group I-2 patient rooms equipped with padded surfaces	1 hour
In Group I-2, physical plant maintenance shops	1 hour
In ambulatory care facilities or Group I-2 occupancies, waste and linen collection rooms with containers that have an aggregate volume of 10 cubic feet or greater	1 hour
In other than ambulatory care facilities and Group I-2 occupancies, waste and linen collection rooms over 100 square feet	1 hour or provide automatic sprinkler system
In ambulatory care facilities or Group I-2 occupancies, storage rooms greater than 100 square feet	1 hour
Electrical installations and transformers	See Sections 110.26 through 110.34 and Sections 450.8 through 450.48 of NFPA 70 for protection and separation requirements.

For SI: 1 square foot = 0.0929 m<sup>2</sup>. 1 pound per square inch (psi) = 6.9 kPa, 1 British thermal unit (Btu) per hour = 0.293 watts, 1 horsepower = 746 watts, 1 gallon = 3.785 L, 1 cubic foot = 0.0283 m<sup>3</sup>.

Refer to the exhibit.

A new, non-sprinklered school building will be constructed as an E occupancy, non-separated, mixed-use building with accessory assembly.

Which of the following incidental use spaces will require a one-hour separation? **Check the two that apply.**

- A. Kitchen
- B. Gymnasium
- C. Main Offices
- D. Chiller Room
- E. 30 HP Boiler Room
- F. 100,000 BTU Furnace Room

**Correct answer:** DE

**CORRECT RESPONSES**

**Chiller Room**

The chiller room is a refrigerant machinery room, and Table 509.1 stipulates that refrigerant machinery rooms must have a 1-hour separation.

**30 HP Boiler Room**

In accordance with Table 509.1, rooms with boilers over 10 HP are required to have a 1-hour separation.

**Section:** Codes & Regulations

**Question 83**

FUNCTION OF SPACE	OCCUPANT LOAD FACTOR <sup>a</sup>		
Accessory storage areas, mechanical equipment room	300 gross	Educational	
Agricultural building	300 gross	Classroom area	20 net
Aircraft hangars	500 gross	Shops and other vocational room areas	50 net
Airport terminal		Exercise rooms	50 gross
Baggage claim	20 gross	Group H-5 fabrication and manufacturing areas	200 gross
Baggage handling	300 gross	Industrial areas	100 gross
Concourse	100 gross	Institutional areas	
Waiting areas	15 gross	Inpatient treatment areas	240 gross
Assembly		Outpatient areas	100 gross
Gaming floors (keno, slots, etc.)	11 gross	Sleeping areas	120 gross
Exhibit gallery and museum	30 net	Kitchens, commercial	200 gross
Assembly with fixed seats	See Section 1004.6	Library	
Assembly without fixed seats		Reading rooms	50 net
Concentrated	7 net	Stack area	100 gross
(chairs only—not fixed)		Locker rooms	50 gross
Standing space	5 net	Mall buildings—covered and open	See Section 402.8.2
Unconcentrated (tables and chairs)	15 net	Mercantile	
Bowling centers, allow 5 persons for each lane including 15 feet of runway, and for additional areas	7 net	Storage, stock, shipping areas	60 gross
Business areas	150 gross	Parking garages	200 gross
Concentrated business use areas	See Section 1004.8	Residential	200 gross
Courtrooms—other than fixed seating areas	40 net	Skating rinks, swimming pools	
Day care	35 net	Rink and pool	50 gross
Dormitories	50 gross	Decks	15 gross
		Stages and platforms	15 net
		Warehouses	500 gross

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m<sup>2</sup>.  
a. Floor area in square feet per occupant.

Refer to the exhibit.

An architect is designing a 4,000-square-foot restaurant building. The kitchen will occupy 30% of the space and the remaining space will be for dining with tables and chairs. The local code requires 0.5 parking spaces per occupant.

How many parking spaces are required?

- A. 96 parking spaces
- B. 97 parking spaces
- C. 192 parking spaces
- D. 193 parking spaces

**Correct answer:** B

**CORRECT RESPONSE**

**97 parking spaces**

**CALCULATIONS**

- Kitchen: 4,000 square feet x 30% = 1,200 square feet / 200 (occupant load factor) = 6 people
- Dining: 4,000 square feet x 70% = 2,800 square feet / 15 (occupant load factor) = 186.66 people, rounded up to 187
- Total occupants: 6 + 187 = 193 occupants
- Total parking spaces required: 193 occupants x .5 = 96.5 parking spaces, rounded up to 97

**Section:** Codes & Regulations

**Question 84**

An architect is designing a single-family residence. To minimize plumbing line lengths, the architect chooses to align the following bathroom fixtures on the same wall:

- A 30"-wide lavatory with vanity
- A 30" x 60" tub and shower
- A toilet

Which size is the most efficient layout for this bathroom?

- 5' x 8'
- 5' x 10'
- 6' x 6'
- 6' x 9'

**Correct answer:** A

**CORRECT RESPONSE**

**5' X 8'**

A 5' x 8' bathroom is the most efficient of the options. In inches, the bathroom would be 60" x 96". The toilet (with 36" of space), the 30-inch lavatory and vanity, and the 30-inch side of the tub and shower would all be placed against one wall, as required. The tub and shower would extend down the 60-inch wall.

**Section:** Project Integration of Program & Systems

**Question 85**

**TABLE 508.4  
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)<sup>f</sup>**

OCCUPANCY	A, E		I-1 <sup>a</sup> , I-3, I-4		I-2		R <sup>a</sup>		F-2, S-2 <sup>b</sup> , U		B <sup>c</sup> , F-1, M, S-1		H-1		H-2		H-3, H-4		H-5	
	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
A, E	N	N	1	2	2	NP	1	2	N	1	1	2	NP	NP	3	4	2	3	2	NP
I-1 <sup>a</sup> , I-3, I-4	1	2	N	N	2	NP	1	NP	1	2	1	2	NP	NP	3	NP	2	NP	2	NP
I-2	2	NP	2	NP	N	N	2	NP	2	NP	2	NP	NP	NP	3	NP	2	NP	2	NP
R <sup>a</sup>	1	2	1	NP	2	NP	N	N	1 <sup>c</sup>	2 <sup>c</sup>	1	2	NP	NP	3	NP	2	NP	2	NP
F-2, S-2 <sup>b</sup> , U	N	1	1	2	2	NP	1 <sup>c</sup>	2 <sup>c</sup>	N	N	1	2	NP	NP	3	4	2	3	2	NP
B <sup>c</sup> , F-1, M, S-1	1	2	1	2	2	NP	1	2	1	2	N	N	NP	NP	2	3	1	2	1	NP
H-1	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	N	NP	NP	NP	NP	NP	NP	NP	NP
H-2	3	4	3	NP	3	NP	3	NP	3	4	2	3	NP	NP	N	NP	1	NP	1	NP
H-3, H-4	2	3	2	NP	2	NP	2	NP	2	3	1	2	NP	NP	1	NP	1 <sup>d</sup>	NP	1	NP
H-5	2	NP	2	NP	2	NP	2	NP	2	NP	1	NP	NP	NP	1	NP	1	NP	N	NP

S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.  
 NS = Buildings not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.  
 N = No separation requirement.  
 NP = Not Permitted.  
 a. See Section 420.  
 b. The required separation from areas used only for private or pleasure vehicles shall be reduced by 1 hour but not to less than 1 hour.  
 c. See Sections 406.3.2 and 406.6.4.  
 d. Separation is not required between occupancies of the same classification.  
 e. See Section 422.2 for ambulatory care facilities.  
 f. Occupancy separations that serve to define fire area limits established in Chapter 9 for requiring fire protection systems shall also comply with Section 707.3.10 and Table 707.3.10 in accordance with Section 901.7.

Refer to the exhibit.

An architect is working on a mixed-use mid-rise building with an automatic sprinkler system. There is a demising wall between a theater and an office space.

How many hours should the demising wall be rated?

- 0
- 1
- 2

**Correct answer: B**

**CORRECT RESPONSE**

**1**

Using chart 508.4, a sprinkled building requires a 1 hour separation between A occupancy and B occupancy.

**Section:** Codes & Regulations

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**Question 86**

Minimum Exhaust Rates	
Occupancy Category	Exhaust Rate cfm/sf
Arena	0.50
Auto repair bays	1.50
Barber shops	0.50
Darkrooms	1.00
Janitor closets	1.00
Kitchenettes	0.30
Parking garages	0.75
Woodwork shop	0.50

Refer to the exhibit.

The design team is selecting exhaust fans for the entire high bay area in the existing auto repair shop. The client wants to purchase the minimum number of fans needed to exhaust existing high bay areas A through D. Exhaust fans can be purchased according to the following:

- Model A exhausts 3,200 CFM and costs \$300
- Model B exhausts 5,000 CFM and costs \$400

Using the exhaust rates in the exhibit, how much should be budgeted for exhaust fans for the entire high bay area?

- A. \$400
- B. \$700
- C. \$800
- D. \$900

**Correct answer: B**

**CORRECT RESPONSE**

**\$700**

The Existing Building Drawings resource indicates that the high bay area is 5,050 square feet. Auto repair bay spaces need to exhaust 1.5 cfm per square foot, meaning that the fans in the high bay area will need to meet or exceed an exhaust rate of 7,575 cfm. One Model A fan and one Model B fan will meet this requirement, exhausting 8,200 cfm for a price of \$700, the lowest price available among the options.

**CALCULATIONS**

1. For the square footage of the high bay area that needs to be exhausted: 1,350 sf + 1,180 sf + 1,180 sf + 1,340 sf = 5,050 sf
2. For the exhaust rate required for the high bay area: 5,050 sf x 1.5 (cfm per square foot needed to exhaust auto repair bays) = 7,575 cfm
3. The amount exhausted by fans needs to be greater than 7,575 cfm.
4. Total cfm exhausted by Model A and Model B: 3200 cfm + 5000 cfm = 8,200 cfm
5. Total cost for Model A and Model B: \$300 + \$400 = \$700

**CASE STUDY RESOURCES USED**

**Scenario**

**Existing Building Drawings**

**Section:** Project Costs & Budgeting

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**Question 87**

Site Utilities Legend

- · W — — — — Domestic water
- UGE — · · · · Power (underground)
- — G — — — — Gas
- · · · · SAS — · · · · Sanitary sewer
- · — SD — · · · · Storm drain

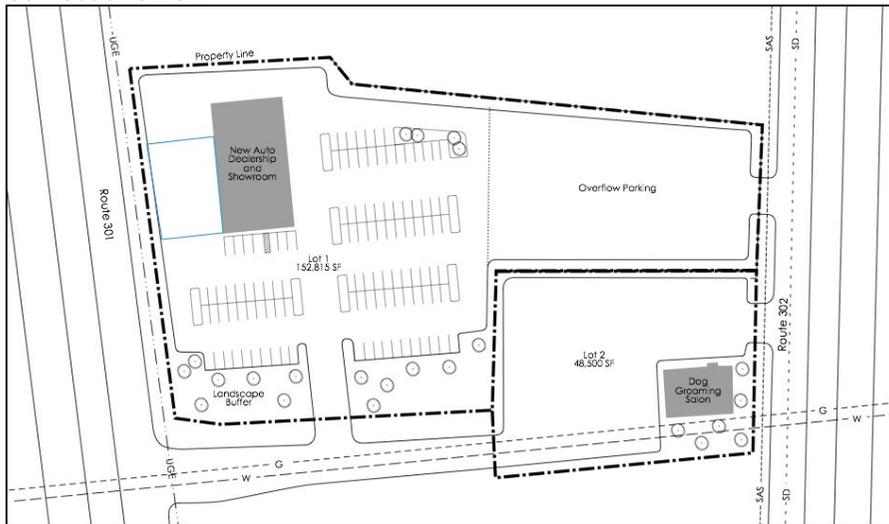
Refer to the exhibit.

The design team is developing a preliminary site plan. The architect meets a representative from the local power company at the project site to determine the location for a new pad-mounted exterior transformer to serve the auto dealership and showroom. The new transformer must be located according to the following requirements:

- Minimize the length of high voltage cable on the property.
- Retain the current electrical room location in the existing auto repair shop building.
- Retain the current parking layout and vehicle circulation.

Click on the area of the site plan to indicate the appropriate location for the pad-mounted exterior transformer.

**Correct answer:**



**CORRECT RESPONSE**

**Area between the western property line and the new auto dealership and showroom**

A pad-mounted exterior transformer steps down high voltage distribution to a lower voltage to serve the building. The underground power line (UGE) shown on this plan is the high voltage distribution line. To minimize the length of high voltage cable on the property, the transformer should be placed on the west side of the property near the high voltage (UGE) line. The length of the cable from the transformer to the main distribution panel in the existing electrical room must also be minimized. The floor plan in the existing building drawings resource indicates that the electrical room is on the west side of the building, about 35 feet from the south exterior wall. The area on the site plan that meets the requirements, then, is the area near the UGE line and aligned with the existing electrical room.

**CASE STUDY RESOURCES USED**

**Scenario**

**Existing Building Drawings**

**Section:** Project Integration of Program & Systems

**Question 88**

A structural engineering consultant reviews the existing auto repair building and determines that due to the large openings in the east and west walls, lateral bracing is needed at the high bay area of the plan. The architect wants to choose the lateral system that is most appropriate for the size and structure of the repair bays.

Which lateral system should the architect choose?

- A. Cross-braced frame
- B. Shear wall
- C. Rigid frame

**Correct answer:** C

**CORRECT RESPONSE**

**Rigid frame**

Rigid frames allow the large openings within each bay to remain intact.

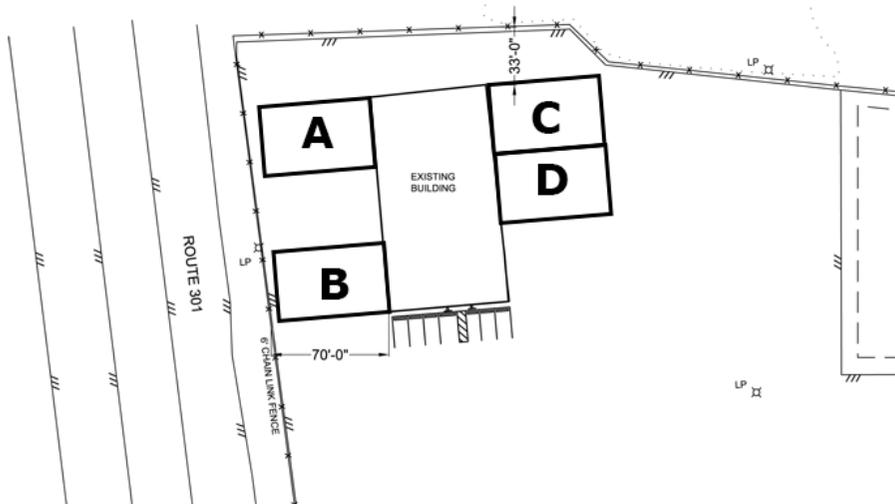
**CASE STUDY RESOURCES USED**

**Scenario**

**Existing Building Drawings**

**Section:** Building Systems, Materials, & Assemblies

**Question 89**



Refer to the exhibit.

The client wants to expand the existing building in order to double the size of the future automobile showroom. The expansion should be contiguous with the automobile showroom.

Which location on the site plan is the most appropriate area for the expansion?

- A. A
- B. B
- C. C
- D. D

**Correct answer:** D

**CORRECT RESPONSE**

**D**  
The expansion footprint needs to be to the east of the existing building because the Scenario indicates that the automobile showroom is planned for the northern half of the building where the high bays are currently, according to the existing building drawings, and the expansion should be contiguous with the showroom. Locations A, B, and C violate the setback requirements stipulated in the Scenario.

**CASE STUDY RESOURCES USED**

**Scenario**  
**Existing Building Drawings**

**Section:** Project Integration of Program & Systems

**Question 90**

The developer wants the dance studios in the performing arts center to be placed in a location where they will receive indirect natural light.

Which one of the following locations is most appropriate for the dance studios?

- A. On the ground floor with exposure to Avenue A.
- B. On the ground floor with exposure to Avenue B.
- C. On the fourth floor with exposure to Avenue A.
- D. On the fourth floor with exposure to Avenue B.

**Correct answer:** D

**CORRECT RESPONSE**

**On the fourth floor with exposure to Avenue B.**

Exposure to Avenue B means exposure to the north, where the dance studios will receive indirect light. Additionally, by placing the dance studios on the fourth floor, they will be in position to avoid shadows from adjacent buildings.

### **CASE STUDY RESOURCES USED**

**Scenario**  
**Site Plan**

**Section:** Project Integration of Program & Systems

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#### **Question 91**

As part of the conversion of the Historic Church Building to a performing arts space, a new mechanical system is proposed. The following costs are associated with the Church's existing and proposed mechanical systems:

- Annual operations and maintenance cost of existing mechanical system: \$3.75 per square foot
- Annual operations and maintenance cost of proposed mechanical system: \$2.25 per square foot
- Initial cost of proposed mechanical system: \$25.00 per square foot

How many years will it take for the proposed system to show cost savings over the existing system? Round to the nearest year.

- A. 14 years
- B. 17 years
- C. 20 years

**Correct answer:** B

#### **CORRECT RESPONSE**

**17 years**

#### **CALCULATIONS**

1. Initial cost of the proposed system: 12,500 sf (square footage of Historic Church Building) x \$25 (initial cost per sf for proposed system) = \$312,500
2. Annual operation and maintenance costs of proposed system: 12,500 sf x \$2.25 (operation and maintenance cost per sf for proposed system) = \$28,125
3. Total costs for proposed system: \$312,500 + \$28,125 = \$340,625
4. Annual operation and maintenance costs of existing system: 12,500 sf x \$3.75 (operation and maintenance cost per sf for existing system) = \$46,875
5. Difference in operation and maintenance costs between the proposed and existing system: \$46,875 - \$28,125 = \$18,750
6. Years for the proposed system to show cost savings: \$312,500 (initial cost of the proposed system) / \$18,750 (cost savings per year) = 16.67 years (rounded to 17)

### **CASE STUDY RESOURCES USED**

**Scenario**

**Section:** Project Costs & Budgeting

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#### **Question 92**

The developer asks the architecture firm to consider an exposed wood structure with no internal columns for the Proposed Gallery.

Which structural system is most appropriate?

- A. Gang-nail trusses with plywood decking
- B. Composite I-joists with plywood decking
- C. Glulam beams with T&G wood decking
- D. Heavy timber with T&G wood decking

**Correct answer:** C

#### **CORRECT RESPONSE**

**Glulam beams with T&G wood decking**

Deep glulam sections are capable of very long spans and are appropriate for an exposed structure.

### **CASE STUDY RESOURCES USED**

**Scenario**  
**Site Plan**

**Section:** Building Systems, Materials, & Assemblies

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#### **Question 93**

The developer asks the architecture firm to provide indirect natural light to the Gallery. The developer's requirements should still be met, and the light should provide even illumination.

Which design option should the firm choose?

- A. Full-height curtainwall adjacent to the Existing School.
- B. Series of clerestory windows oriented toward the Existing Church.
- C. Series of clerestory windows oriented toward the Proposed Parking Garage.

**Correct answer: C**

**CORRECT RESPONSE**

**Series of clerestory windows oriented toward the Proposed Parking Garage.**

Clerestory windows oriented toward the Proposed Parking Garage, which is to the north, would accommodate even, indirect illumination.

**CASE STUDY RESOURCES USED**

**Scenario  
Site Plan**

**Section:** Environmental Conditions & Context

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**Question 94**

D.O.G. Security LLC informs JJP Architects that future expansion of the veterinary clinic should be considered in addition to the other project criteria. Based on this information, JJP Architects is considering changing the building construction to Type I-B to maximize the allowable building area for future additions.

Which building element will require additional fireproofing to meet the 1-hour fire resistance requirement of the new construction type?

- A. Wall assembly
- B. Roof assembly
- C. Floor assembly

**Correct answer: B**

**CORRECT RESPONSE**

**Roof assembly**

The roof assembly consists of exposed metal decking that requires fireproofing to meet the 1-hour fire resistance rating.

**CASE STUDY RESOURCES USED**

**Scenario  
Drawings**

**Section:** Codes & Regulations

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**Question 95**

To achieve the required acoustic privacy requested by D.O.G. Security, the walls in the Surgery room need to include acoustic batt insulation (additional \$13.50 per linear foot). JJP Architects needs to estimate the additional cost to add batt insulation based on the approximate length of the interior walls rounded to the nearest 6" increment, excluding the door.

What is the additional cost to add batt insulation to the Surgery room? Round to the nearest whole number.

- A. \$65
- B. \$89
- C. \$581
- D. \$797

**Correct answer: C**

**CORRECT RESPONSE**

**\$581**

The total cost increase is based on the length of walls that require acoustic insulation. The two side walls are each shown as 14'-6" from the exterior of the CMU to the inside of the interior wall. Since that exterior assembly is 11-1/4" deep, the length of these walls can be rounded to 13'-6". The third interior wall is 15'-8" from inner face to outer face. Accounting for the thickness of the south wall, the length of the wall can be estimated at 16'. The total length of all interior walls is estimated at 43'.

**CALCULATIONS**

1. 14'-6" (side walls) - 11-1/4" (exterior wall depth) = 13'-6 3/4", rounded to 13'-6"
2. 15'-8" (third interior wall) + 4" (rounded interior wall depth) = 16'

3. 13'-6" + 13'-6" + 16' = 43' (total length of interior wall requiring batt insulation)
4. 43' (total length of interior wall requiring batt insulation) x \$13.50 per linear foot (cost of batt insulation) = \$580.50 (rounded to \$581)

**CASE STUDY RESOURCES USED**

Scenario  
Drawings

**Section:** Project Costs & Budgeting

**Question 96**

After reviewing revised energy code requirements, JJP Architects discovers that insulation in the exterior wall construction needs to increase from the originally designed R-21 to R-25. JJP analyzes insulation options that can be added to the exterior wall assembly, and they need to select an option that will have a minimal impact on the current design.

What insulation option should JJP Architects select?

- A. 3" of rigid insulation at R4 per inch.
- B. 6" of batt insulation for an additional R5.
- C. Solid grouted CMU for an additional R2.

**Correct answer:** A

**CORRECT RESPONSE**

**3" of rigid insulation at R4 per inch.**

The current wall assembly includes 2" of rigid insulation. By increasing the depth to 3", the R-value is increased by R4 from the original design, which meets the R-25 requirements with minimal impact to the current design.

**CASE STUDY RESOURCES USED**

Scenario  
Drawings

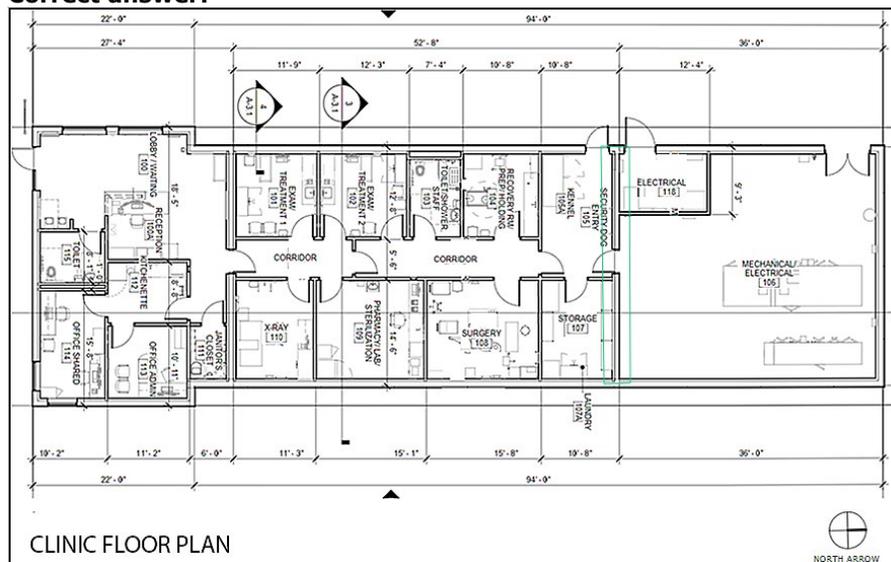
**Section:** Building Systems, Materials, & Assemblies

**Question 97**

JJP Architects has started to review fire protection concepts to be coordinated with their consultants during the project's design development phase.

Click on the wall in the plan below that will require fire dampers for life safety purposes.

**Correct answer:**



**CORRECT RESPONSE**

**Southern wall of Mechanical/Electrical 106 and Electrical 116**

According to the Life Safety Plan, this is a fire barrier and will require fire dampers.

**CASE STUDY RESOURCES USED**

Scenario

**Drawings**

**Section:** Codes & Regulations

**Question 98**

A newly-established state code requires bicycle parking for at least 5% of the building occupants.

Assuming an occupant load factor of 150 gross and a building area of 5,708 GSF, how many bicycle parking spaces must be included in the design?

- A. 2 spaces
- B. 3 spaces
- C. 4 spaces
- D. 5 spaces

**Correct answer:** B

**CORRECT RESPONSE**

**3 spaces**

According to the case study scenario, local zoning requires 1 bicycle parking space for every 20 vehicular parking spaces. The drawings show 49 vehicular parking spaces, which would then necessitate 3 bicycle parking spaces. The newly established state code only requires 2 bicycle parking spaces (see calculations below) In this case, the local zoning code is more stringent and should be followed.

**CALCULATIONS**

1. 49 (vehicular parking spaces) / 20 (1 bicycle parking space per 20 vehicles) = 2.45 bicycle parking spaces (rounded to 3)
2. 5,708 GSF (building area) / 150 (occupant load factor) = 38.05 occupants (rounded to 39)
3. 39 (occupant count) x 5% = 1.95 bicycle parking spaces (rounded to 2)

**CASE STUDY RESOURCES USED**

**Scenario**  
**Drawings**

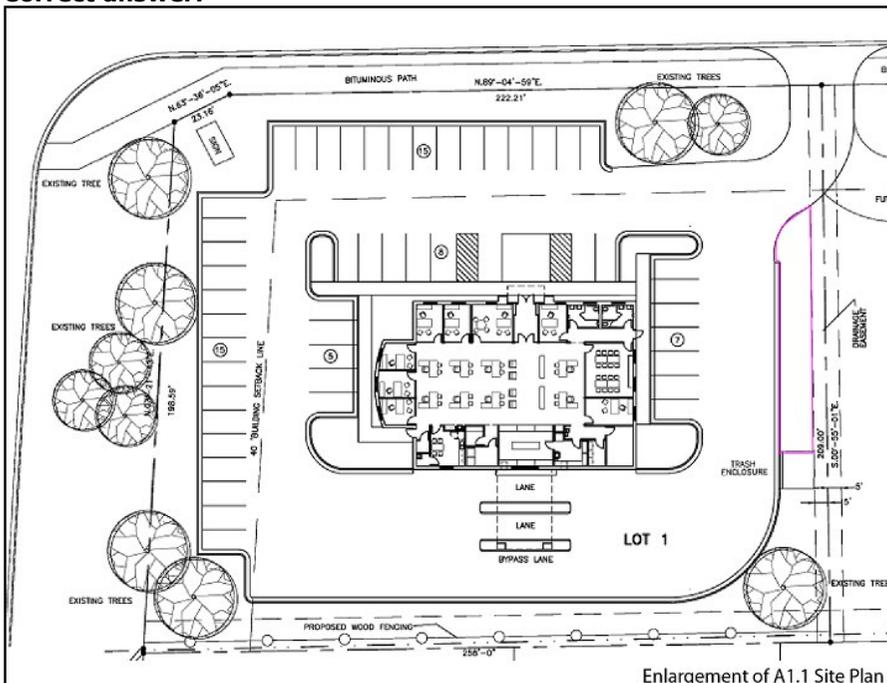
**Section:** Codes & Regulations

**Question 99**

The client wants to add an exterior standby pad-mounted generator to the project. According to local code, equipment cannot be located within 20' of the exterior wall of the building. The pad for the generator will be 8' wide by 10' long. Assume parking spaces are 24' deep.

Click on the area in the site plan that would be the most economical location for the pad-mounted generator.

**Correct answer:**



**CORRECT RESPONSE**

**Area to the north of the trash enclosure**

This location is closest to the mechanical/electrical room without being in a utility easement or within 20' of the exterior wall of the building.

**CASE STUDY RESOURCES USED**

**Scenario**  
**Drawings**

**Section:** Project Integration of Program & Systems

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**Question 100**

How many bike parking spaces are required?

- A. 1 space
- B. 2 spaces
- C. 3 spaces
- D. 4 spaces

**Correct answer:** C

**CORRECT RESPONSE**

**3 spaces**

**CALCULATION**

1.  $49$  (total vehicular parking spaces) /  $20$  (1 bike space per 20 vehicular parking spaces) =  $2.45$  (rounded up to 3).

**CASE STUDY RESOURCES USED**

**Scenario**  
**Drawings**

**Section:** Codes & Regulations

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**Testing Resources**

For more information on test preparation references and resources, as well as testing policies and procedures, please refer to the ARE 5.0 Guidelines, available on [ncarb.org](http://ncarb.org).