

Student: _____

Date: _____



GUIDING CLIMBING ON ARTIFICIAL SURFACES EXAM Time limit = 1 hr 30 min

This exam is designed to identify any gaps that may exist in your knowledge. Missed exam questions may indicate that you require specific refresher training. Poor performance indicates that you are not yet ready to earn a qualification. Each missed exam question must be thoroughly reviewed until competency is achieved.

Carefully read each question then choose the *most* correct answer. This exam should be completed without the assistance or advice of others. You may refer to your own notes.

Competency can be demonstrated by initially scoring 100%

- Q1. You are conducting organised climbing activities on an artificial structure for a group of participants. Could the climbing structure (including the belay systems and the immediate surrounding area) be regarded as a **workplace** according to the WHS legislation in Australia?

Yes No

Explain your answer:

- Q2. This question is about PPE (personal protective equipment).

Is a climbing harness PPE? Yes No

If you answered 'yes', according to Australian Standards, how often (ie at what intervals) must a harness be checked by a competent person to ensure it is fit for use?

- Q3. In the context of climbing on an artificial surface, are supervising staff required to be competent to recognise and then respond to an emergency/incident?

Yes No

Explain your answer:

- Q4. This question relates to Q3 above. In the context of artificial surfaces, list at least 4 different types of emergencies that involve imminent risk of a fall or loss of control. Assume the emergencies require immediate staff intervention to bring the situation under control.
Note: Do not list emergencies of a *medical nature* such as heart attacks, stroke, fainting, seizures, asthma attack, snapped tendons, etc. Fires, smoke, robbery and structural collapse are also excluded. Think in terms of human error – errors caused by either the climber or the belayer.

1. _____

2. _____

3. _____

4. _____

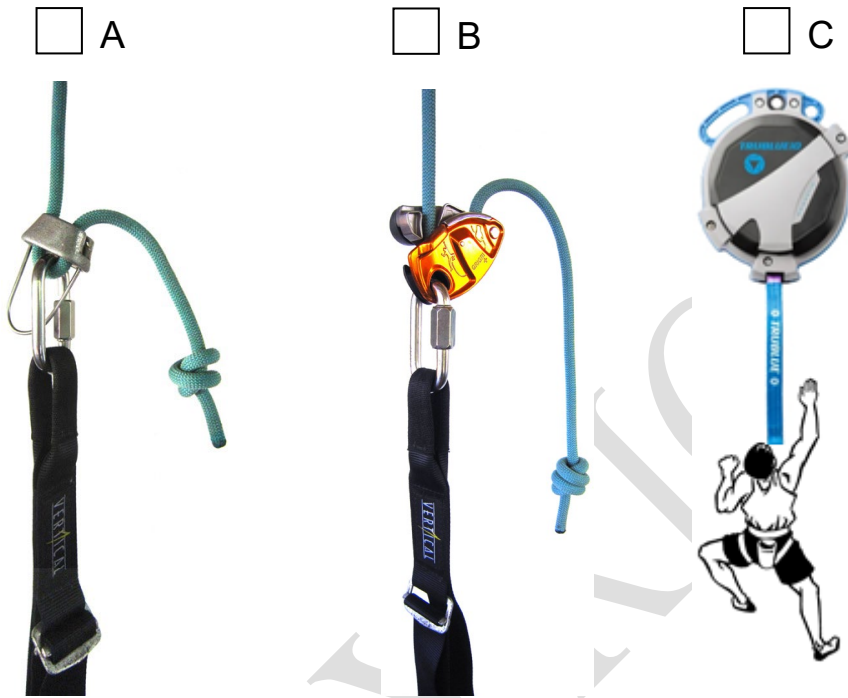
Q5. Study the photos of the manual belay systems carefully. Choose the configuration you believe provides the best combination of connector security, stability, resistance to misalignment, and accidental removal (or potential theft). You will be required to explain your answer.



Explain your answer:

- Q6. In broad terms, we can think of all climbing related safety belay systems as being either:
- manual braking devices
 - cam assisted self-locking devices
 - auto-belay devices (no human belay person required).

Thought experiment: If you were the owner/manager of an indoor rock climbing facility (artificial surfaces), which belay system would you choose? Answer this question from the point of view of an employer/manager at a commercial indoor climbing facility.



Explain your answer: (give sound reasoning to back your choice)

Which belay system is the cheapest? (ABC)

Which belay system is the most expensive? (ABC)

Does cost have an impact on your choice? Yes No

Q7. Study the images carefully. Choose the floor mounted anchor sling you believe will be most effective in terms of ease of adjustment, potential for misuse, and ease of attachment. Explain your answer.

A



B



C



D



Explain your answer:

Q8. Study the photos, A and B. Choose the photo you believe is best practice for top rope climbing on an artificial surface (eg at an indoor climbing gym). You will be required to explain your answer.

A



B



Explain your answer:

Q8a. Would your answer be different if the person being belayed was a lead climber? Explain.

Yes

No

Q9. The following question refers to belay devices. Choose the device you believe would be best suited for top rope climbing at an indoor artificial climbing facility (eg climbing gym) where the customers have wide ranging and random skill levels (ie from total novice to experienced climber). You will be required to explain your choice...

A



B



C



D



E



F



G



H



Explain your answer with sound reasoning:

Q10. What do each of the following belay devices have in common?



GriGri +



Matik



Eddy

Explain your answer:

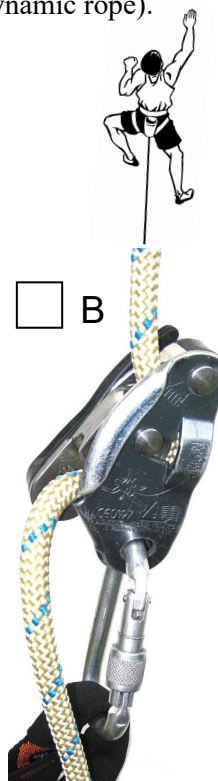
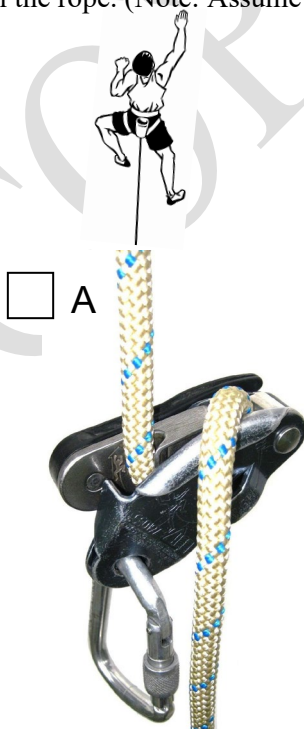
Q11. Study the photo. Does it matter what rope diameter is used in cam assisted self-locking belay devices? Why? Are these devices only designed for dynamic rope or can low stretch (abseil) rope also be used?



- A It does matter – the correct diameter rope is critical for safety.
- B It doesn't matter – you can use any rope diameter.

Explain:

Q12. Study the photos of the belay device. Choose the photo you believe indicates the correct way to install the rope. (Note: Assume the rope is in fact an EN892 dynamic rope).



The following questions relate to auto-belays.


Q13. There are two main competing auto-belay devices available:

- 1) Trublue (Headrush technologies USA); and
- 2) Perfect descent (C3 Manufacturing USA).


One uses opposing magnetic fields to enable braking, the other uses sacrificial brake pads (like drum brakes in a car).

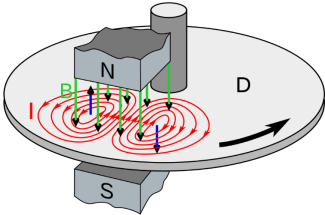
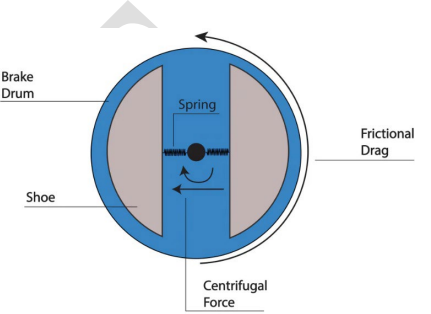
Match the device to the braking technology it employs. Indicate your answers below.

A



B



For each device, choose the correct answer:

A Trublue

B Perfect descent

Q13a According to EN 341, what is the maximum allowable descent speed for auto-belay units? m/s
Note: EN 341 is the world defacto standard for auto-belays.

Q13b. Indicate the minimum and maximum allowable **body weight** for each unit (in kg).

TRUBLUE	
Minimum	Maximum

PERFECT DESCENT	
Minimum	Maximum

Q14. This question is in relation to how to anchor an auto belay device. For each position marked 'A, B, C' – indicate its intended purpose. Indicate your answer in the space below.



A	
B	
C	

Q14a. Study the photos carefully. One of the carabiners has an 'eye' (hole). What is the purpose of this 'eye'? Explain: (do you think it is a good idea – or not?)

A



B



Explain your answer:

Q14b. TRUE or FALSE:

Auto-belays require mandatory annual inspection and servicing by an authorised agent.

True

False

Q15. This question is in relation to attachment systems for auto-belays. Study the photos 'A, B, C' – then choose the option you think provides the highest level of safety (ie minimises risk). Indicate your answer. Include any benefits/advantages you think your choice offers (compared to the others).

A



B



C



Explain your answer:

Q16. This question is in relation to webbing on auto-belays Study the photos A, B, C, D.
Choose the webbing you think is unsafe – and should be immediately reported to your manager. Indicate your answer. There may be more than one answer...

A



B



C



D

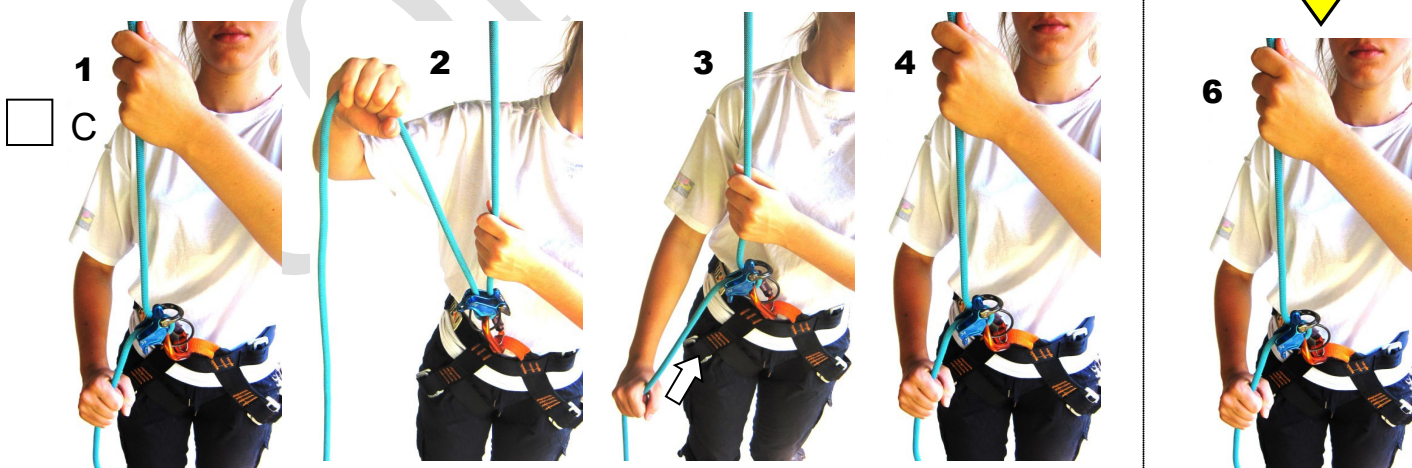
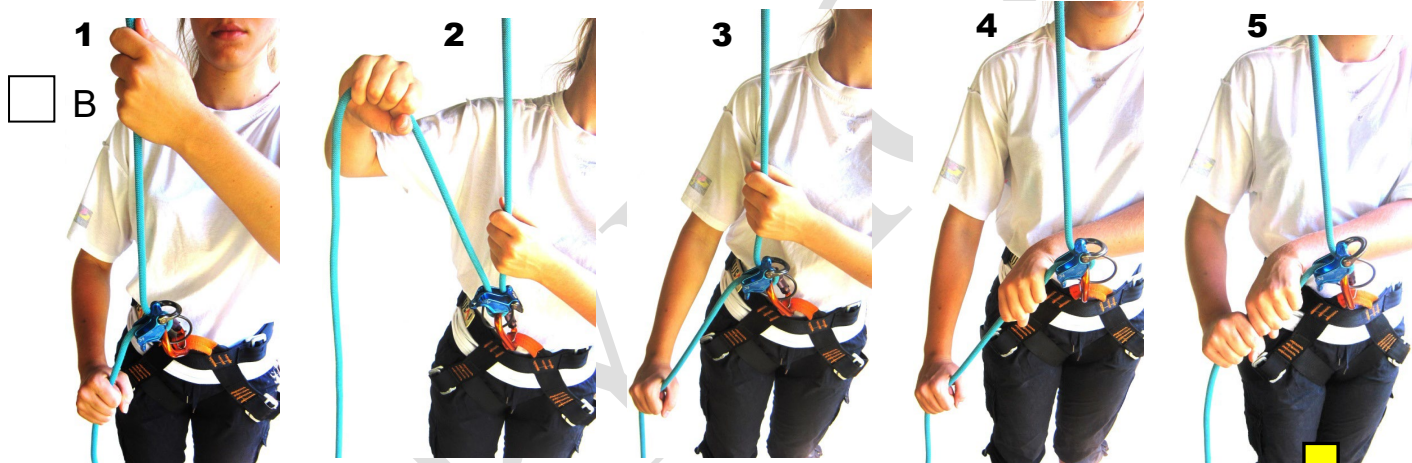
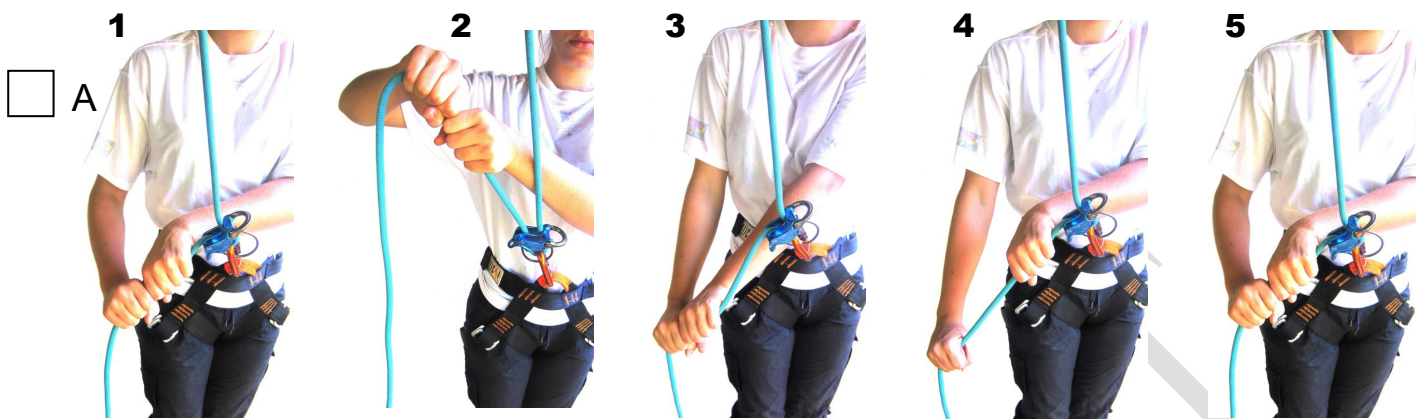


Edge view



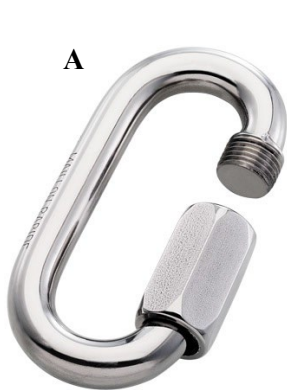
Q17. Study the photos carefully. This question is about belay techniques that are applicable within the context of an indoor climbing gym (ie artificial climbing surface). Choose the technique you believe will be easiest for staff to teach and which can be more easily applied by the belayer.

You will be required to explain your answer.



Explain your answer:

Q18. Study the photos of the connectors carefully. Match the descriptor to its corresponding connector. Write the corresponding letter of the alphabet in each of the box's.



1. Carabiner:
 Auto-locking gate (triple-action)
 Resistant to misalignment
 Gate resistant to vibrations
 Fixed captive eye

2. Carabiner:
 Screw gate locking mechanism
 Susceptible to misalignment
 Gate can rattle loose due to vibrational energy

3. Maillon rapide:
 No hinged gate
 Gate highly resistant to vibrations
 Robust
 Strong in multiple loading profiles

4. Carabiner:
 Auto-locking gate (triple-action)
 High resistance to misalignment
 High resistant to roll-out
 Gate resistant to vibrations

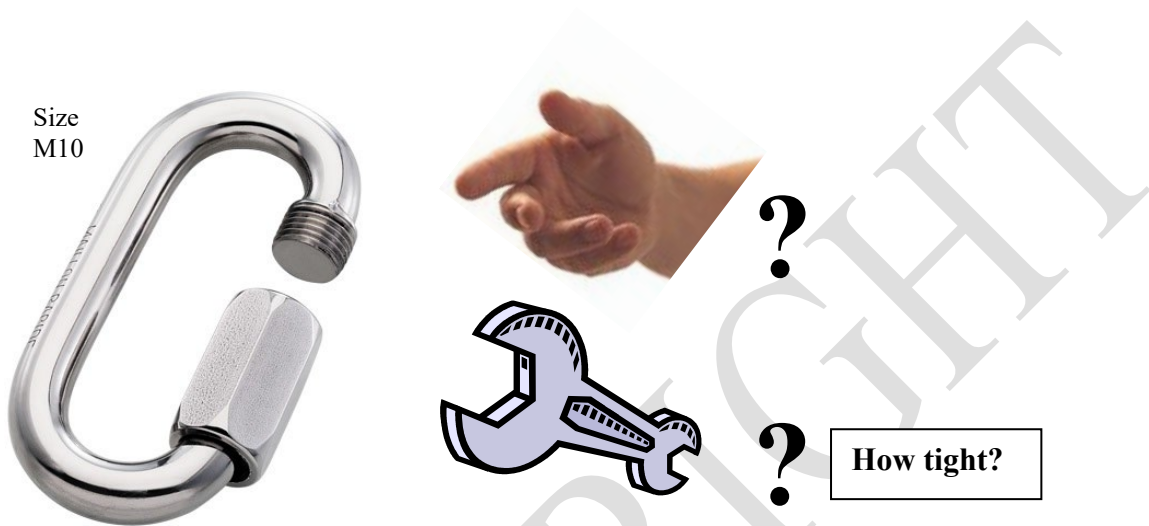
Q19. Explain the meaning of the markings etched (or stamped) on a carabiner. Refer to the image below. Write your explanations in the space provided below...



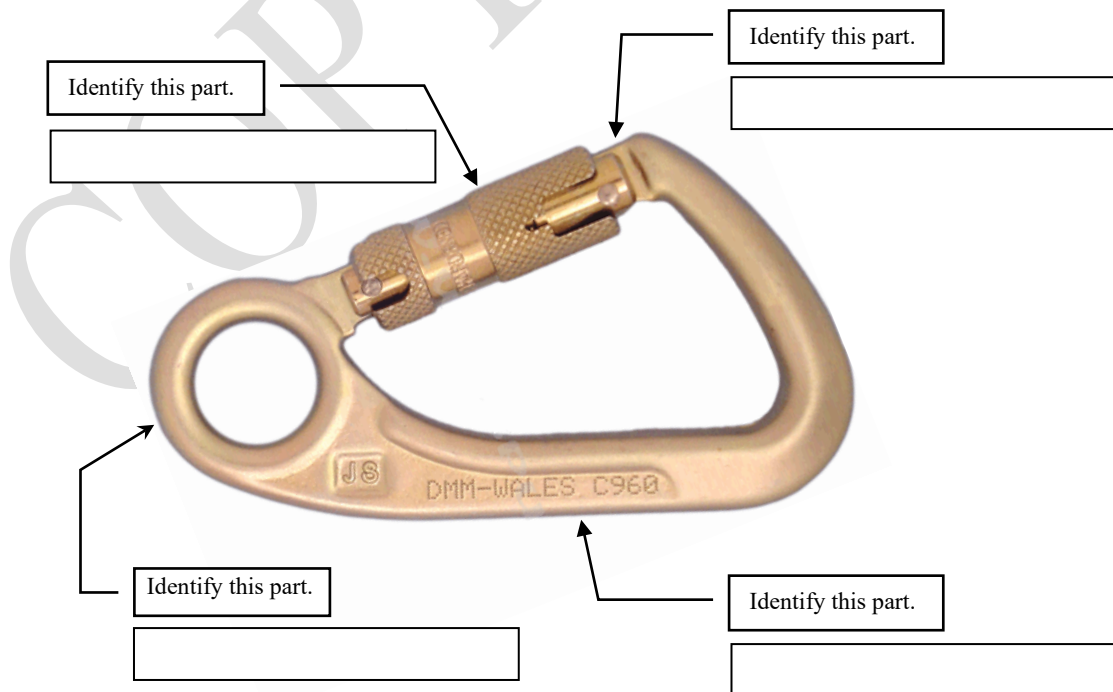
- A CE
- B 0474
- C UIAA
- D kN
- E ◀▶ 27
- F ⚡ 9
- G ⚡ 9

Q20. This question refers to Maillon Rapides (also known as ‘quick links’). Are they required to be tightened in a certain way? Choose a response you believe is correct.

- A By hand only – screwing all the way as hard as you can by hand.
- B Only with a torque wrench (it is pre-set to a specific force)
- C With a spanner – nipped up firmly.
- D By hand, screw all the way closed, and then back off ¼ turn.
- E No, there is no particular way to tighten a Maillon rapide.



Q21. Identify each of the parts of the carabiner. Write your answers in the space provided.

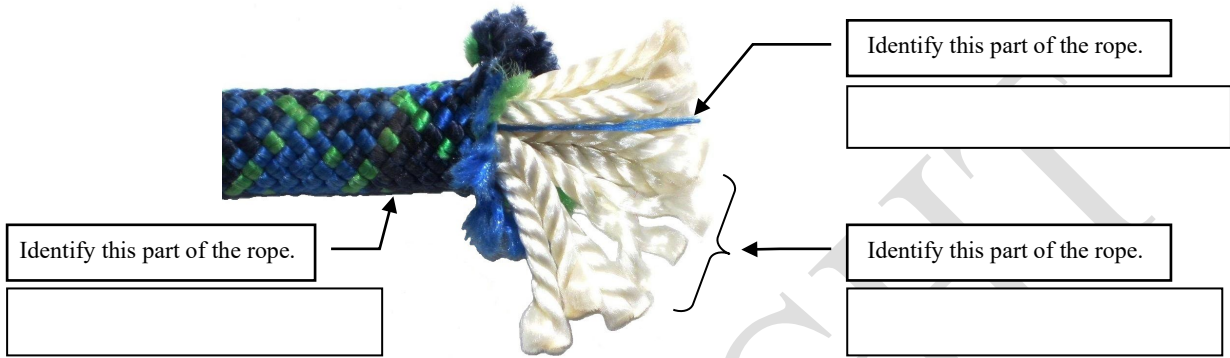
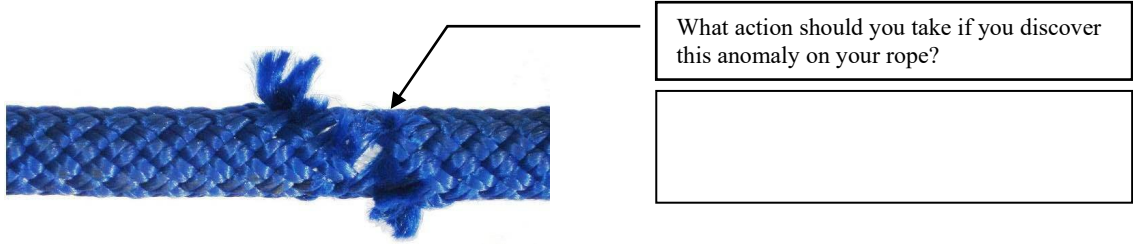


Q22. Study the photos carefully. This question deals with rope attachment to a climber's harness for top rope climbing activities on artificial climbing surfaces. Choose the attachment system you believe will provide the best combination of security and stability and also reduce the risk of human error.



Explain your answer:

Q23. The following question deals with rope. Answer each of the questions below.



Write the type of rope each standard is referring to in the box provided.

STANDARD **TYPE OF ROPE**

A **EN 892**

B **EN 1891**

What is the maximum *theoretical* lifespan of a climbing rope?

- A 6 months
- B 1 year
- C 2 years
- D 5 years
- E 10 years
- F None of the above.

What type of rope would be best suited for manually operated (ie human operated) belay systems on artificial surfaces?

Why (explain)?

Q24. The following question deals with belay safety systems.
 Answer the questions below by entering a letter of the alphabet (A, B, or C).

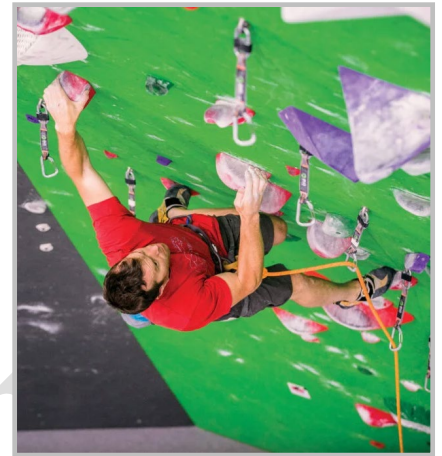
A



B



C



Which photo shows a lead climbing belay system? _____

Which photos shows a top rope belay system? _____

Which photo shows an auto belay system? _____

Provide answers in the text boxes below (list 2 advantages and 2 disadvantages for each belay system):

**Manual (human operated) belay systems:
 Advantages / disadvantages**

**Auto belay systems:
 Advantages / disadvantages**

Advantages:

1.
2.
3.

Disadvantages:

1.
2.
3.

Advantages:

1.
2.
3.

Disadvantages:

1.
2.
3.

Q25. The following question deals with impact attenuation (floor shock absorbing) at artificial climbing structures. Australian Standard AS4422 deals with playground impact materials and is the defacto standard used for artificial climbing structures. Proper impact attenuation materials are critical for preventing brain injuries.

AS4422 allows for two generic types of impact attenuation:

1. Loose fill material (eg sand, bark chips); and
2. Solid material (eg foam/rubber/synthetic matting).



Q25a. Thickness of material must be such that the g_{max} value is less than what amount?

Impact attenuation, is measured by an accelerometer to indicate surface hardness and is reported as a 'g max' value, which is the ratio of maximum negative acceleration on impact in units of gravities (g) to the acceleration due to gravity. $1g$ (Earth's Gravity) = $9.81m/s^2$. The higher the g_{max} value, the poorer the shock attenuation of the material. Example: $10g = 10$ times Earth's gravity.

Q25b. The current standard for installing shock attenuation floor material at playgrounds and climbing gyms requires that g_{max} values must not exceed: (circle the correct response)

- A 2 g
- B 10 g
- C 100 g
- D 150 g
- E 200 g
- F None of the above.

Q25c. How far out (ie to what distance) must the impact attenuation material extend outwards from the climbing wall?

- A 1.0m
- B 1.5m
- C 2.0m
- D 2.5m
- E 2.0m out from all vertical surfaces and additional distance will be required for any overhangs which project out from the main wall.
- F None of the above.

Q26. Study the photo carefully then answer the questions in the space provided.



26a. Almost universally, when climbing outdoors (on real cliffs) climbers wear a helmet. But indoors (on artificial surfaces) helmets are rarely worn. Why? (explain).

26b. A pictorial summary of the EN12492 standard for rock climbing helmets is at this link:
 Link: https://www.theuiaa.org/documents/safety-standards/Pictorial_UIAA106%20Helmets.pdf

Are helmets designed to protect a person from potential injuries sustained from a free-fall to the ground (ie falling off and then hitting the ground from height)?

Yes No

26c. What is the mass (kg) used to test a helmet from penetration by a sharp/pointed falling object?

26d. Is there a legal requirement to wear a helmet when climbing indoors on an artificial surface?

Yes No

26e. There might be some circumstances where an indoor climbing facility may require helmets to be worn. List at least 3 reasons why a manager/owner of a climbing gym might require helmets to be worn. You are invited to list as many reasons as you can think of...

1	
2	
3	
4	
5	



Q27. Study the photo carefully then answer all of the questions in the space provided.

What is the name of this device? _____

What is the device designed to do? _____

List 2 uses for the device in the context of an artificial climbing structure (eg at an indoor climbing venue).

1. _____

2. _____



Q28. This question refers to the maximum lifespan of PPE used in climbing applications.

All climbing equipment can be broadly divided into 2 categories; 'software' (textile products, eg harnesses, ropes, slings, etc) and 'hardware' (metal products, eg carabiners, chains, maillon rapides, etc).

Write the *maximum* theoretical lifespan for each product category below:

Software: _____ years

Hardware: _____ years

Q29. Explain the meaning of the following climbing safety calls (within the context of an indoor climbing gym). This question relates to human operated belay systems.

SAFETY CALL	MEANING
On belay / Belay ready	
Climber ready	
'Have you got me?' / 'Got me?'	
Lower me	

Q30. What does each letter of the following safety checklist mean? ABCDEF

	SHORT DESCRIPTOR	DETAILED MEANING
A		
B		
C		
D		
E		
F		

Q31. Study the photos carefully. Choose the harness design type that you believe will be best suited for general use at an indoor climbing gym. You will be required to explain your answer.

A

B

C



Explain your answer:

Q32. Study the photos carefully. Choose the photo you believe indicates the correct fit and adjustment for a climbing harness.

A



B



Q33. Sometimes, a hold can loosen and become a 'spinner'. Staff should have a policy for dealing with spinner holds.

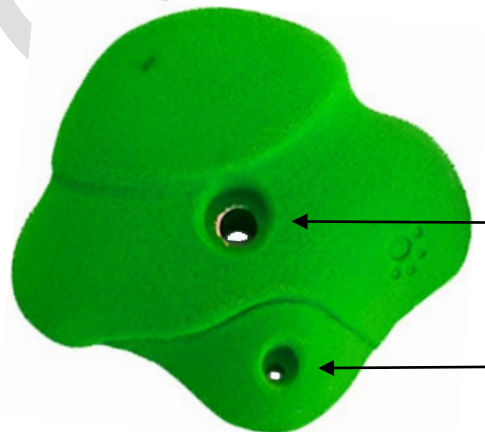
Q33a. How tight should the bolt be fastened into the wall (and 'T nut')? Indicate your answer:

- A As tight as you can physically turn it by hand
- B Use a power tool to drive the bolt as tight as possible
- C Leave it loose (spinning) – it doesn't matter
- D Call a tradesman – only they are permitted to tighten the bolt
- E Tighten only to the point where it stops spinning
- F None of the above are correct.



How tight?

Q33b. Some holds have 2 holes. Why? Identify the purpose of each hole (answer in space below).

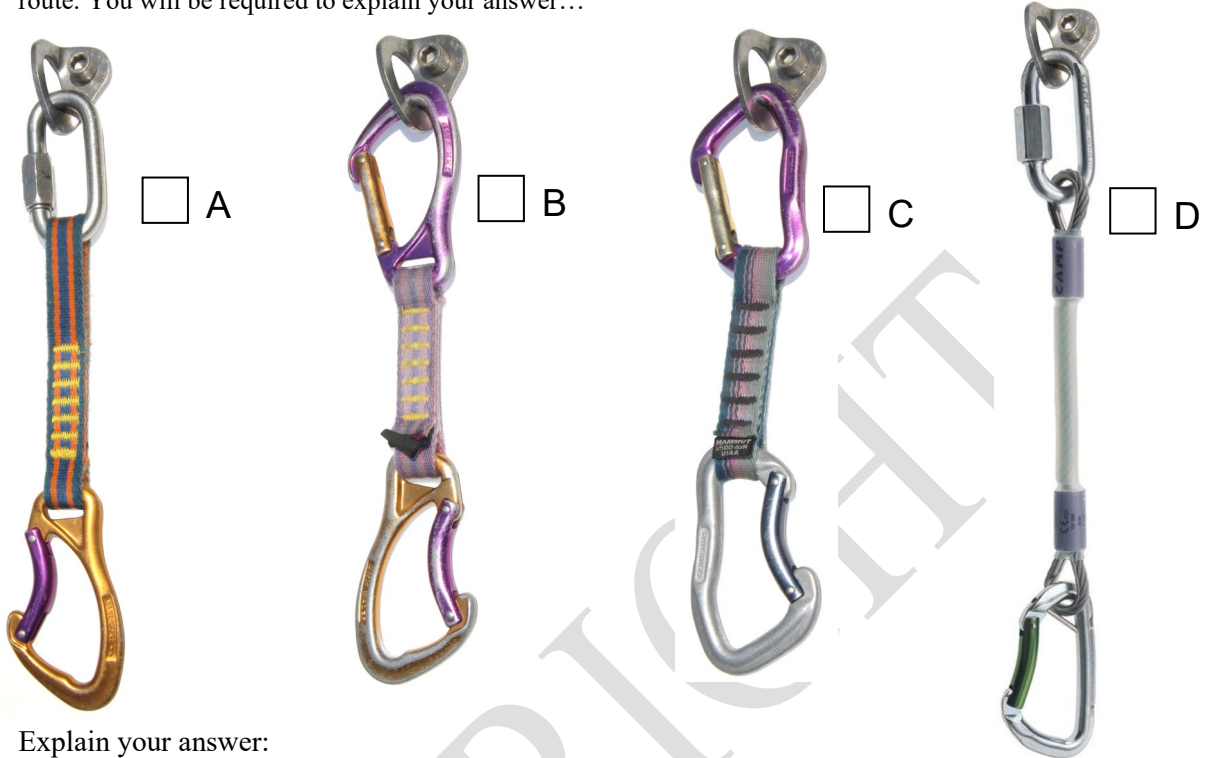


Explain what each hole is intended for:

The following questions are for lead climbing applications...

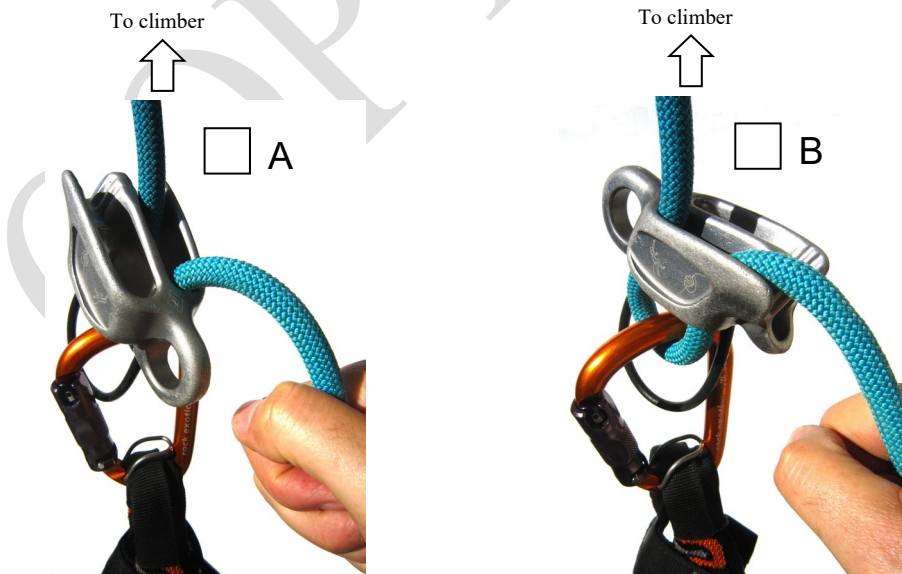
COPYRIGHT

Q34. Study the photos carefully. An indoor climbing gym (artificial surface) is planning to setup some routes for 'lead climbing'. This will attract new customers and create additional interest for existing customers to acquire new skills. Choose the connective setup you believe provides the best combination of security, robustness, and safety for lead climbers who will be progressively clipping their rope as they climb the route. You will be required to explain your answer...



Explain your answer:

Q35. Study the photos carefully. Choose the photo you believe shows the correct way to thread a climbing rope through the belay device (in order to maximise friction).



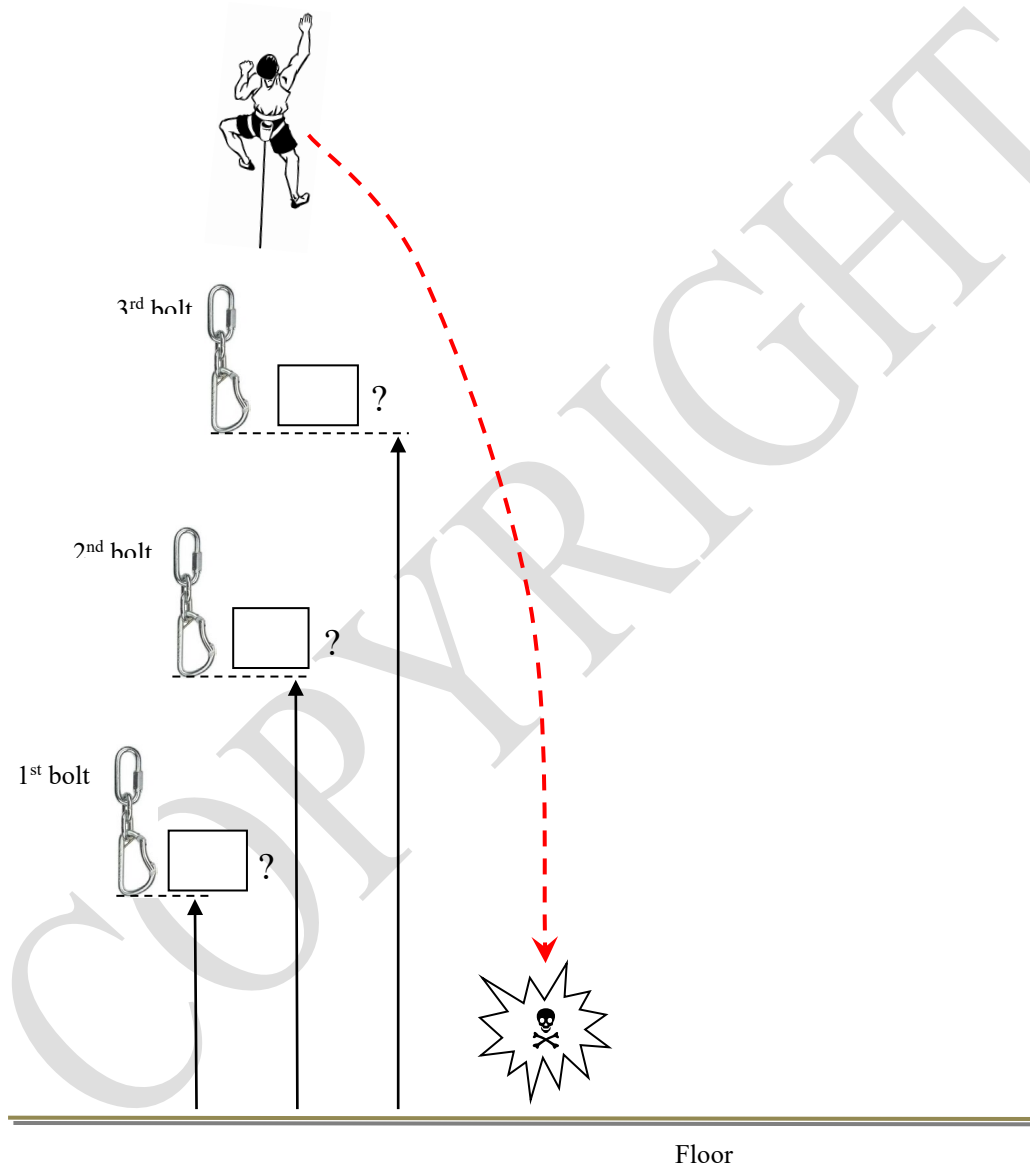
Explain your answer:

Q36. Study the diagram carefully.
This question deals with proper installation of fixed protection at a climbing facility to reduce the risk of a ground fall when people undertake lead climbing activities.

Indicate the required linear distance from the floor of climbing facility to each of the first 3 bolts so that a lead climber cannot 'hit the deck' (ie suffer a ground fall) when belayed by a competent belay person.

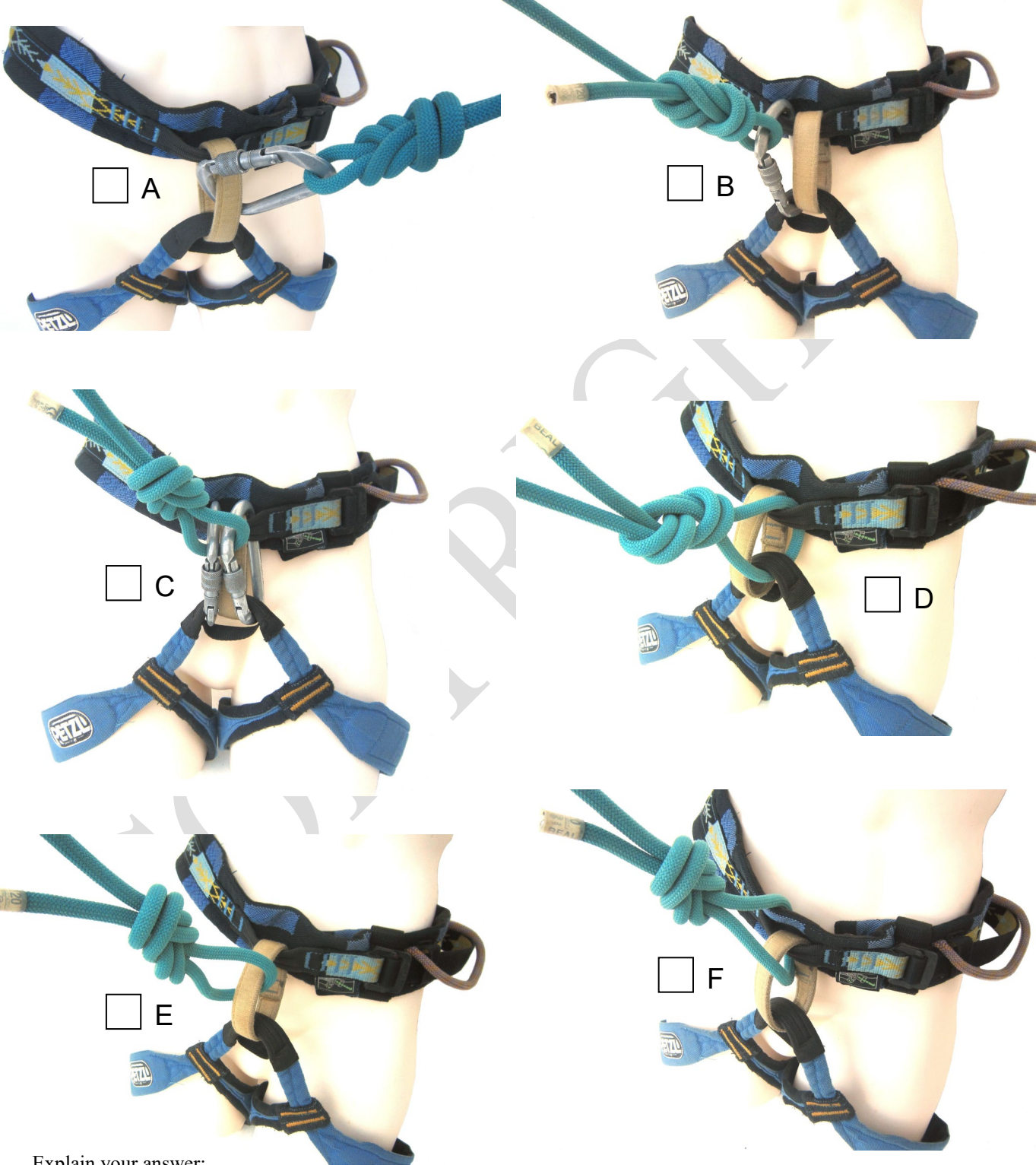
Note: Assume the belay person is competent and experienced and that a fall is immediately arrested with a cam assisted self-locking device such as a GriGri.

Enter your answers (in metres) in each of the boxes.



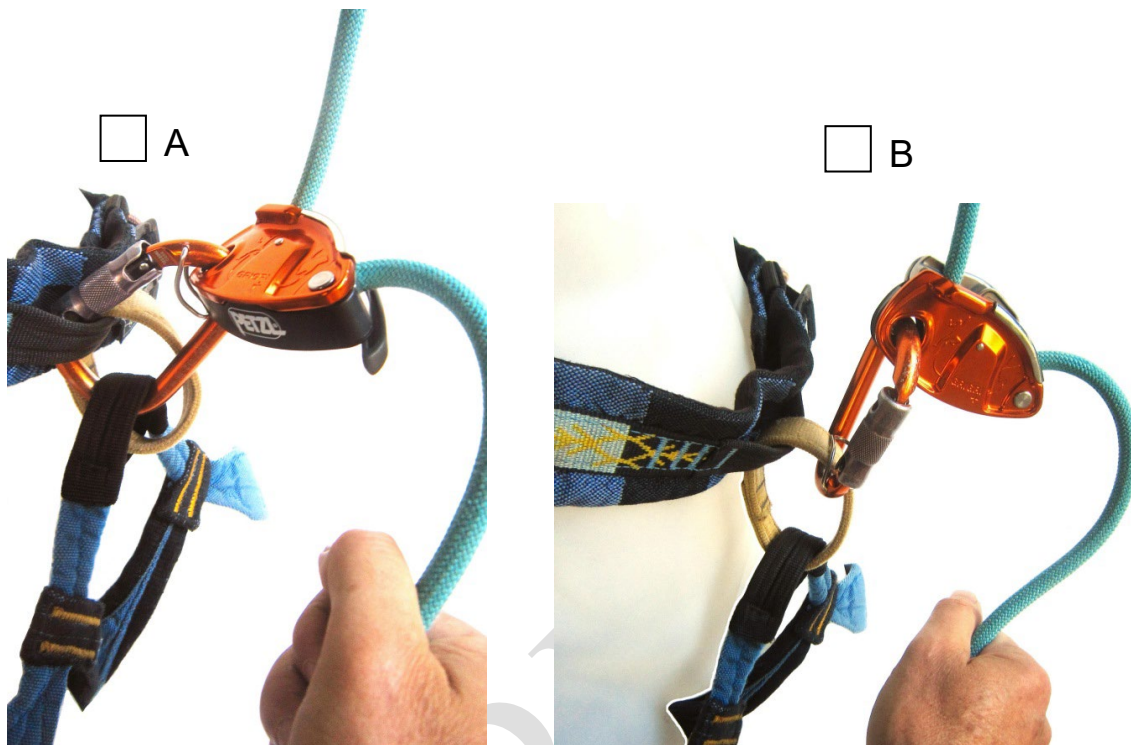
This question is specific to lead climbing activities on artificial surfaces.

Q37. Study the photos carefully. Choose the photo you believe indicates the best combination of *stability* and *security* in terms of rope attachment to a lead climber's harness. You will be asked to explain your answer. **Note: Some of the photos show rope attachment methods that are potentially life threatening.**



Explain your answer:

Q38. Study the photos carefully.
 You are intending to belay a lead climber on an artificial climbing surface. Choose the photo you believe is the correct way of attaching the belay device to your harness. You will be required to explain your answer.



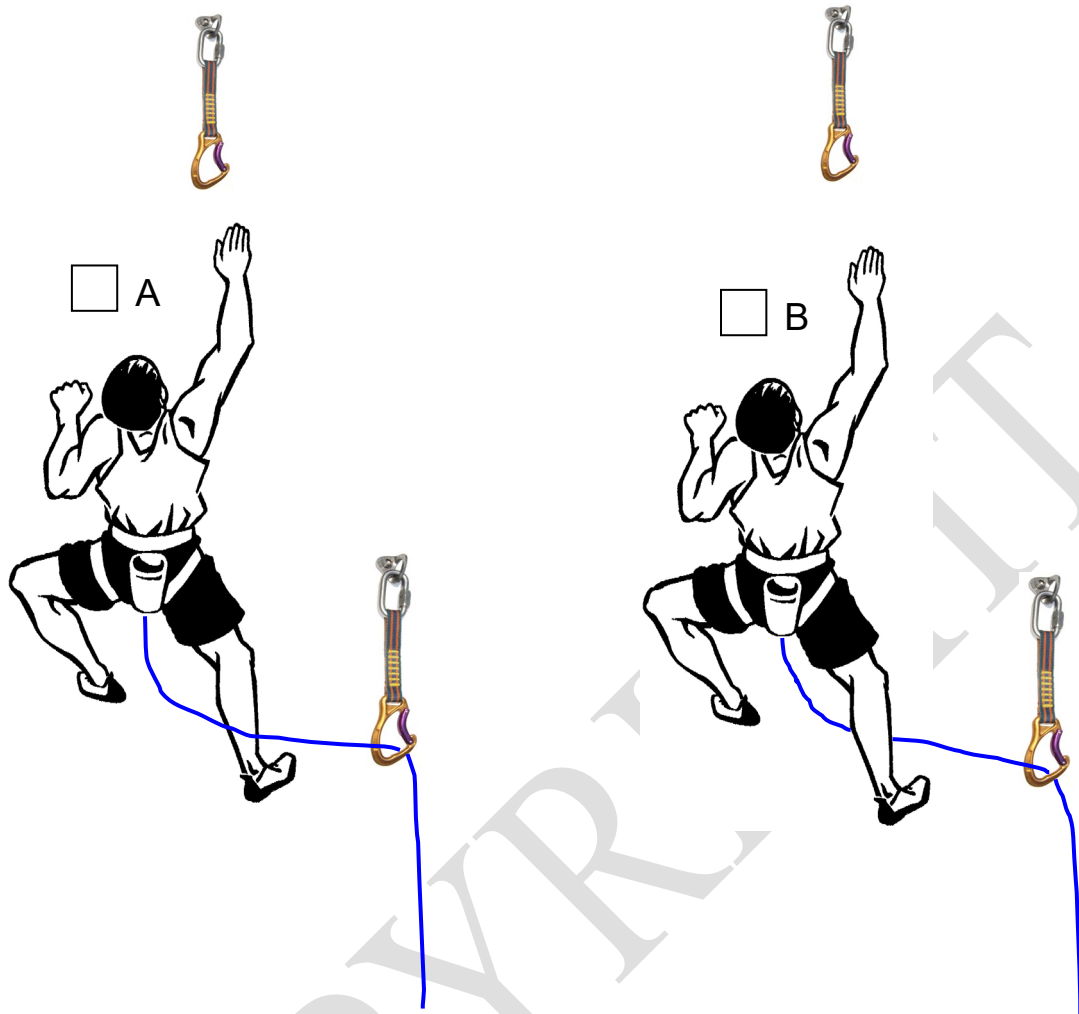
Explain your answer:

Q39. Study the photos carefully.
 Which harness design type is best suited for lead climbing?



Explain your answer:

Q40. Study the diagram carefully. Choose the correct diagram. Explain your answer.



Explain your answer:

Score _____

STUDENT STATEMENT:

I declare that I completed this exam paper without the assistance of others. My answers represent my own work and not the work of someone else. I realise that my exam score is an indication of my current knowledge in the context of climbing on artificial surfaces. I acknowledge that my health and safety, and the safety of others may depend on my knowledge and skill.

Student signature: _____

Date: _____