

Student: _____

Date: _____

ANCHOR SYSTEMS DIAGNOSTIC EXAM**Time limit = 1 hour 30 min**

(Natural surfaces)



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 gain 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 must be completed without the assistance or guidance from others. You may refer to your own notes, and other reference material.

Competency can be demonstrated by initially scoring 100%

- Q1. Anchor systems are *fundamental* to all roping activities at height (eg abseiling, rock climbing, canyoning, vertical rescue, etc). By definition, knots will need to be tied to form an anchor system. In the context of building anchors, which knots do you consider to be very important? From the range of knots below, rank each knot in terms of its importance in anchor system. Write your answers in the space provided. Note: This is a 'qualitative' question. We are seeking to gain some insight into your underpinning knowledge of anchor systems and how knots are related.

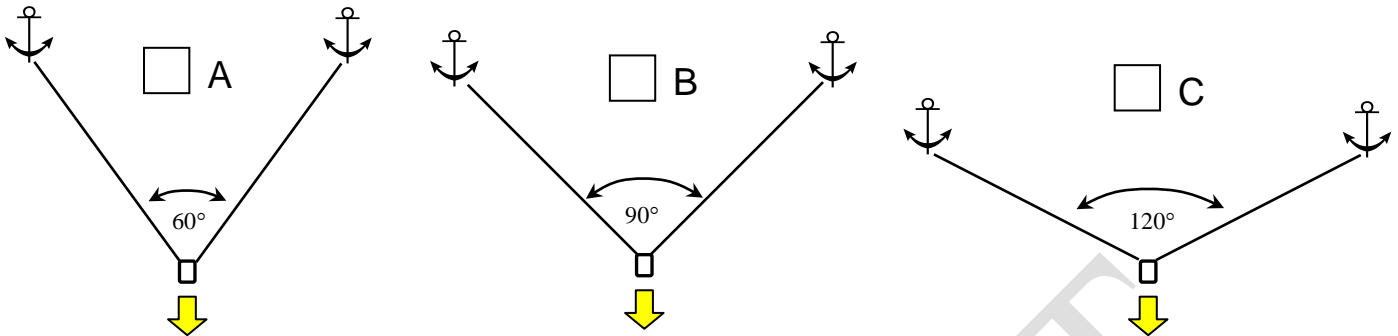
5 = highest importance; 1 = lowest importance; 0 means not important (ie, it is not necessary to know this knot).



If you could only choose one (1) knot, which would it be? Choose from A – H. Write the letter and identify it by name.

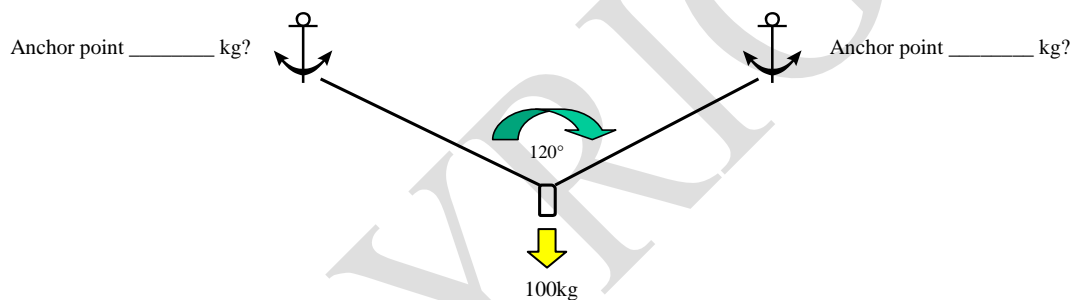
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- Q2. Indicate the anchor system that will transmit the lowest tensional force through to each individual anchor point.



Explain your answer:

- Q3. Indicate the load (force) in kilograms that will be transmitted to each anchor point in the diagram.



Explain your answer:

- Q4. The 'critical angle' beyond which anchor points in a system will be subjected to dangerously magnified (increased) loading is: (you must explain your answer)

- ☐ A 45 degrees
☐ B 60 degrees
☐ C 70 degrees
☐ D 90 degrees
☐ E 120 degrees
☐ F 130 degrees

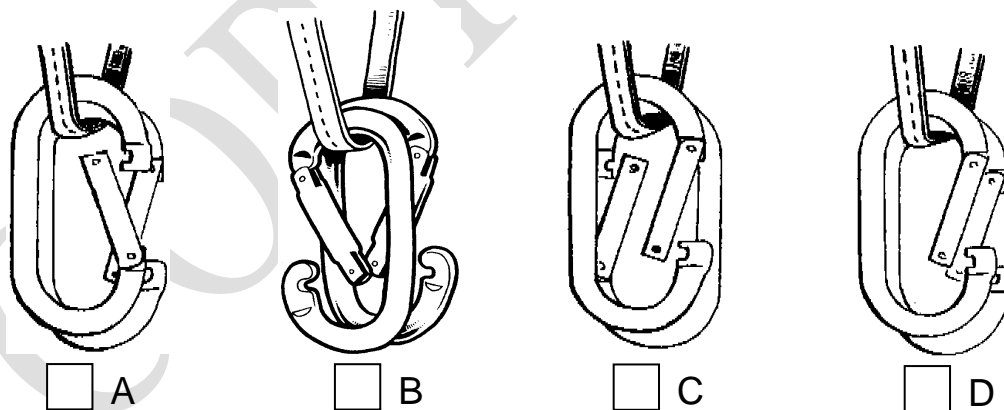
Explain your answer:

Q5. Study the photos carefully. Indicate the anchor system that has no single-point of failure.



Explain your answer:

Q6. Choose the diagram that indicates the correct orientation of non-locking carabiners used at the focal point of an anchor system (you must explain your answer).



Explain your answer:

Q7. The following question is in relation to building and using anchor systems in outdoor recreation situations. Choose the *most correct* response:

- ☐ A It is normally acceptable to rely on a single anchor point.
- ☐ B At least four (4) anchor points must be linked together to form a solid and reliable anchor system.
- ☐ C Anchor systems must have a shock absorber to reduce the risk of failure.
- ☐ D An anchor system consists of two (2) individual natural anchor points which are linked together to form a load sharing system that has no single point of failure.
- ☐ E An anchor system will consist of a *minimum* of two (2) individual anchor points, which are linked to form a load sharing system to avoid creating a single point of failure.
- ☐ F None of the above are correct.

Q8. Before trusting your life to an anchor system, you should conduct a thorough check. PACI recommends the 'SAFER' checklist. What does each letter represent in the acronym below?

S = _____

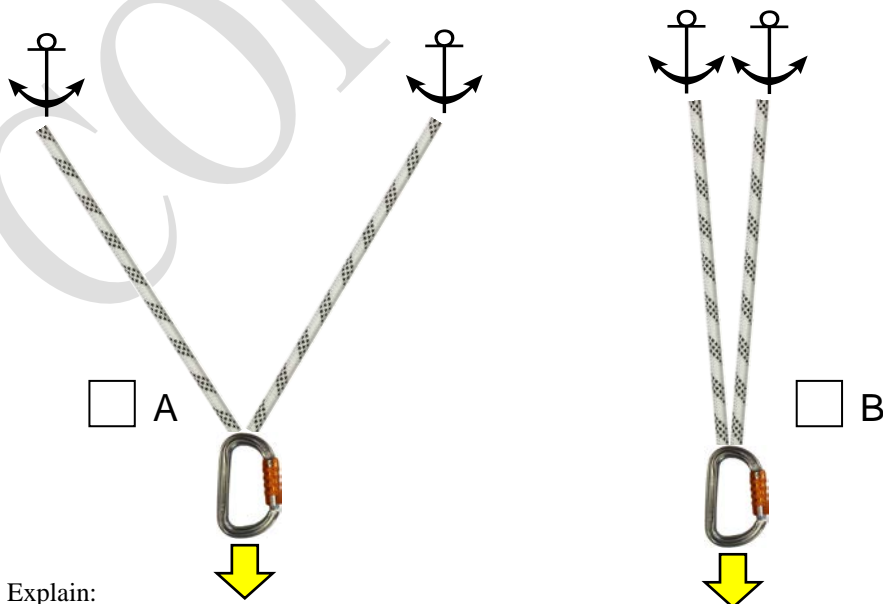
A = _____

F = _____

E = _____

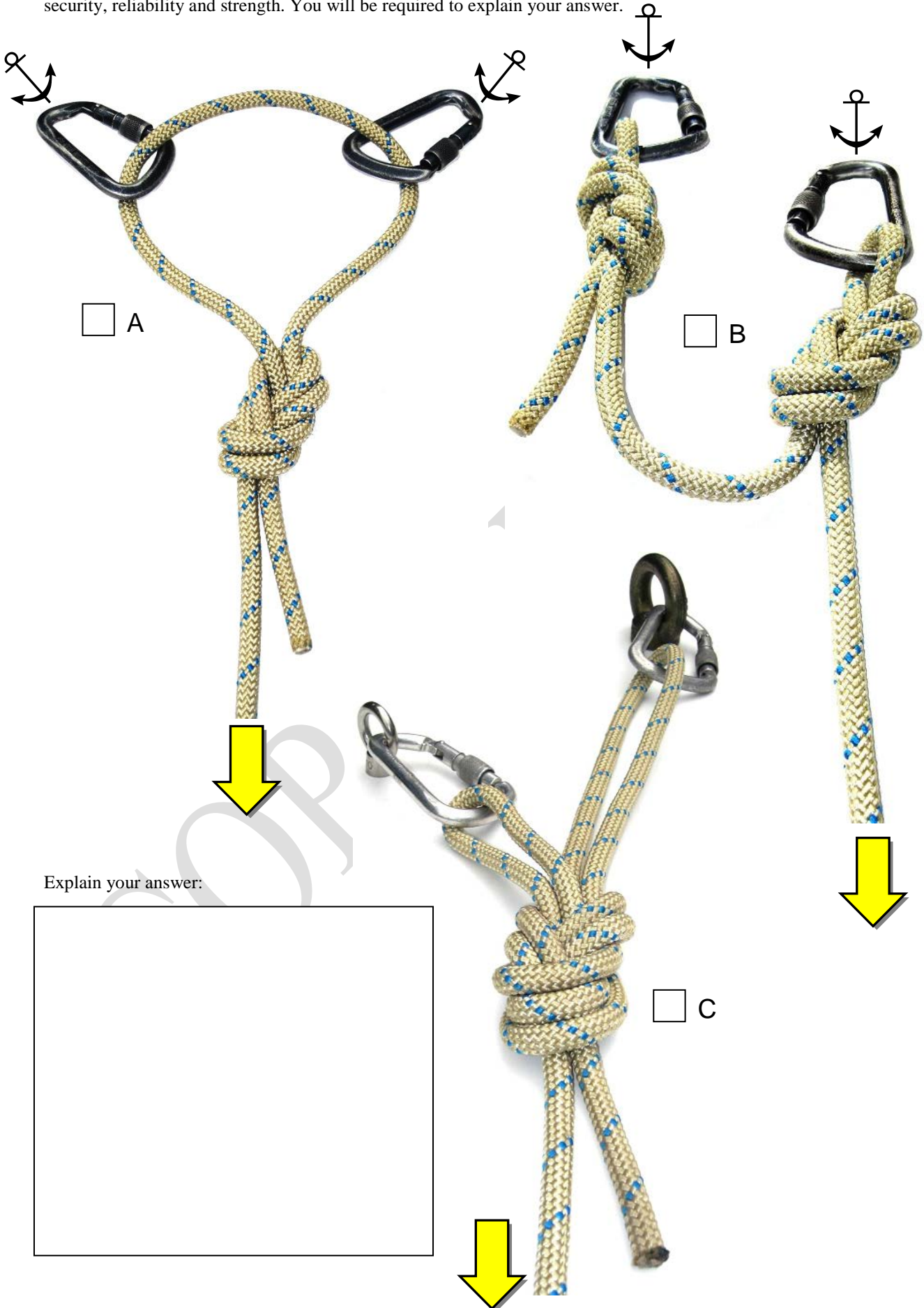
R = _____

Q9. Study the images carefully. Identify the anchor system that you believe is less reliable than the other. You will be required to explain your answer.

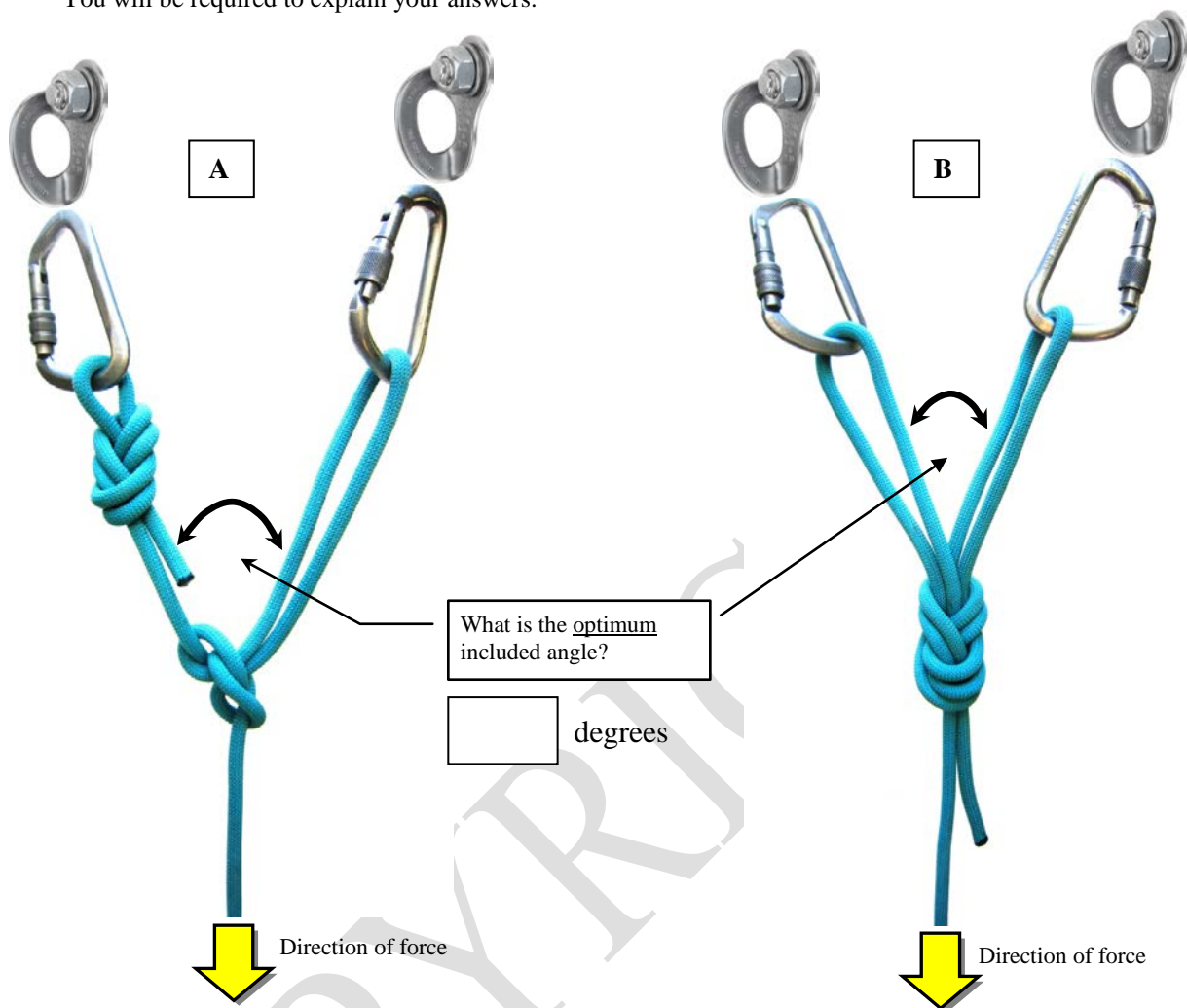


Explain:

Q10. Study the photos carefully. Choose the anchor configuration you believe provides the best combination of security, reliability and strength. You will be required to explain your answer.



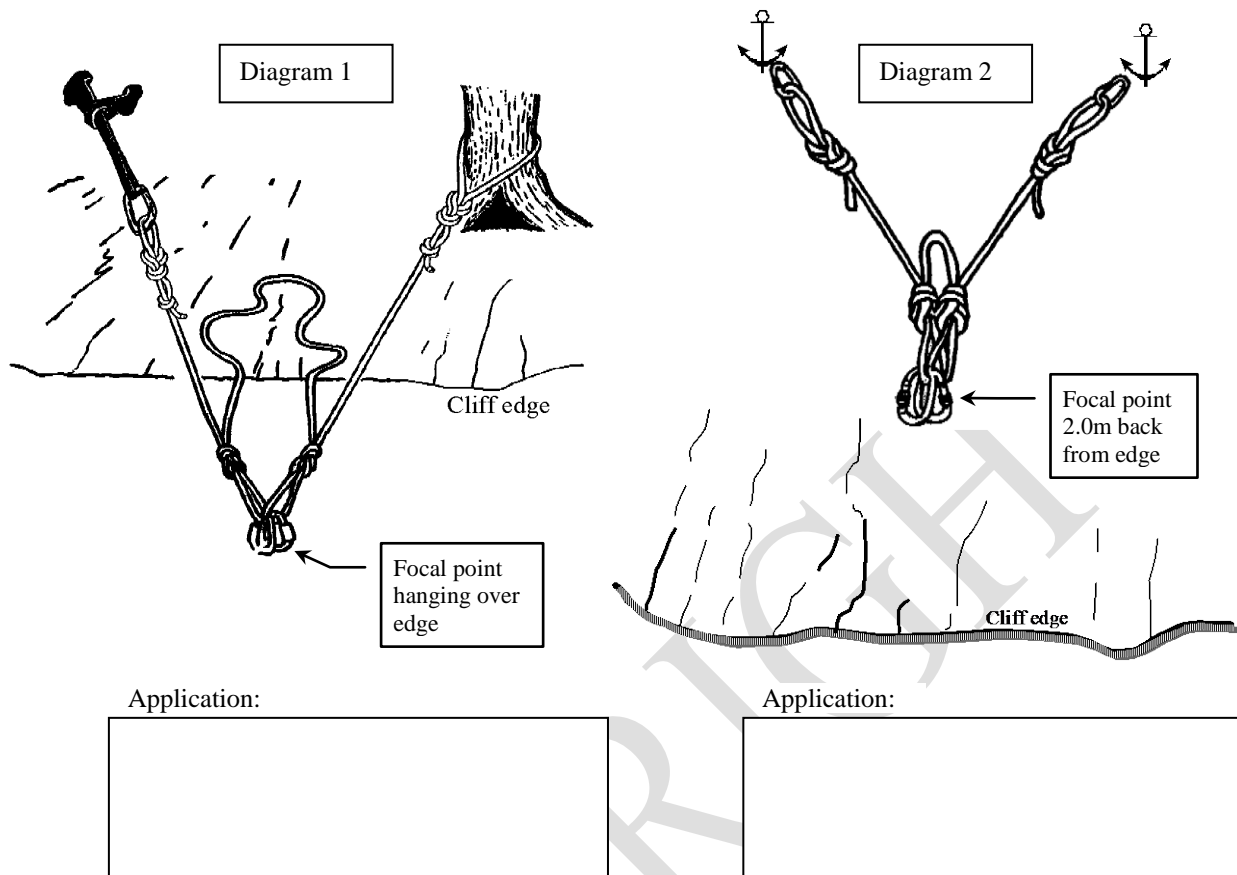
- Q11. Study the photos A and B carefully. Answer the questions where indicated.
You will be required to explain your answers.



- 11a. Do both of these anchor systems fulfil the requirements for no single point of failure?
- ☐ Yes ☐ No Explain: _____
- 11b. Which system do you believe is stronger (ie able to sustain higher load)?
- ☐ A ☐ B ☐ C They are both the same (the difference is not statistically significant – knot strength is largely irrelevant).
- 11c. In terms of tying knots and rigging these anchors, which one do you think is easier and quicker to setup?
- ☐ A ☐ B ☐ C They both take the same amount of time to setup
- 11d. Does one system have advantages over the other?
- ☐ Yes ☐ No

Explain:

- Q12. Study the diagrams carefully. Each anchor configuration is built for a different purpose. Describe an activity that would be suitable for each anchor system.

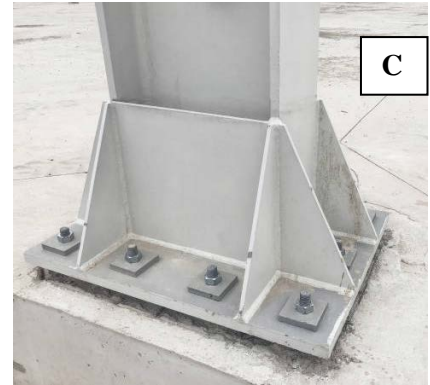


- Q13. Study the diagrams carefully. Indicate the sling configuration that is theoretically able to sustain the highest load (ie force)? Under what circumstances is a girth hitch/choke appropriate? Explain your answer (assume that both the slings and the material surface around which the slings are threaded are identical).



Explain your answer:

- Q14. Study the photos of different types of anchors. Match the descriptor to its corresponding letter.
Write letters of the alphabet (A to H) in each of the box's.
Note: There may be more than one correct answer for each category.



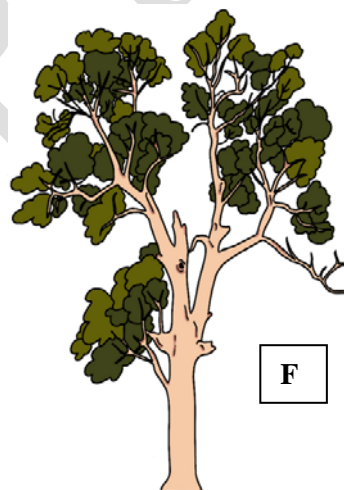
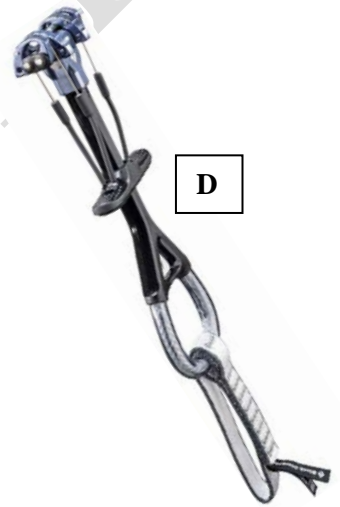
Naturally occurring anchor.....

Existing, permanently installed anchor...

Removable climbing protection device
(passive)

Removable climbing protection device
(active)

Existing structural anchor.....

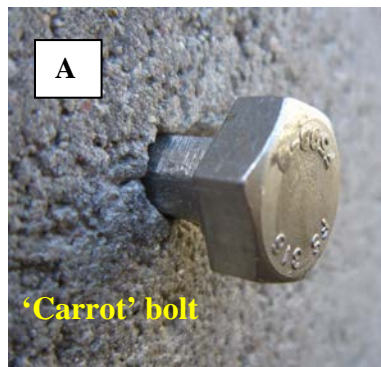


- Q15. Study the photo carefully.
What has caused the issue with one of the anchors? How could this issue be avoided?



Explain your answer:

- Q16. Study the photos carefully. All 'bolt' anchors can be classified into 3 main types. Match the descriptor to its corresponding letter. Write a letter of the alphabet (A, B, or C) in each of the box's.



Chemical

Mechanical

Interference fit



- Q16a. **True or False:**
A chemical anchor exerts continuous force inside the drilled hole.

☐

True

☐

False

- Q16b. **True or False:**
A mechanical anchor exerts no force inside the drilled hole.

☐

True

☐

False

- Q16c. **True or False:**
Interference fit bolts are strongest when loaded in tension (note the difference between shear and tension).

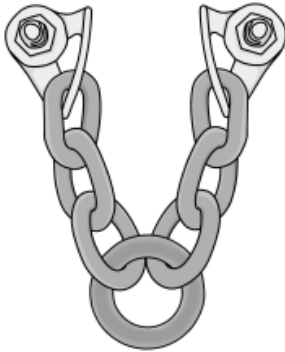
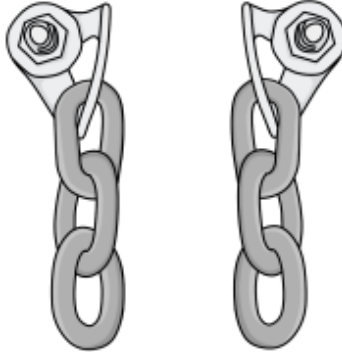
☐

True

☐

False

- Q17. Study the images carefully. Assume that each of the permanently installed anchors have solid and reliable bolts. Choose the configuration you believe has the best combination of safety, longevity, and user friendly design. You may also consider if the configuration has user replaceable parts.

☐ A☐ B☐ C☐ D☐ E☐ F

- Q17a. Is there a configuration that is less reliable than the others?

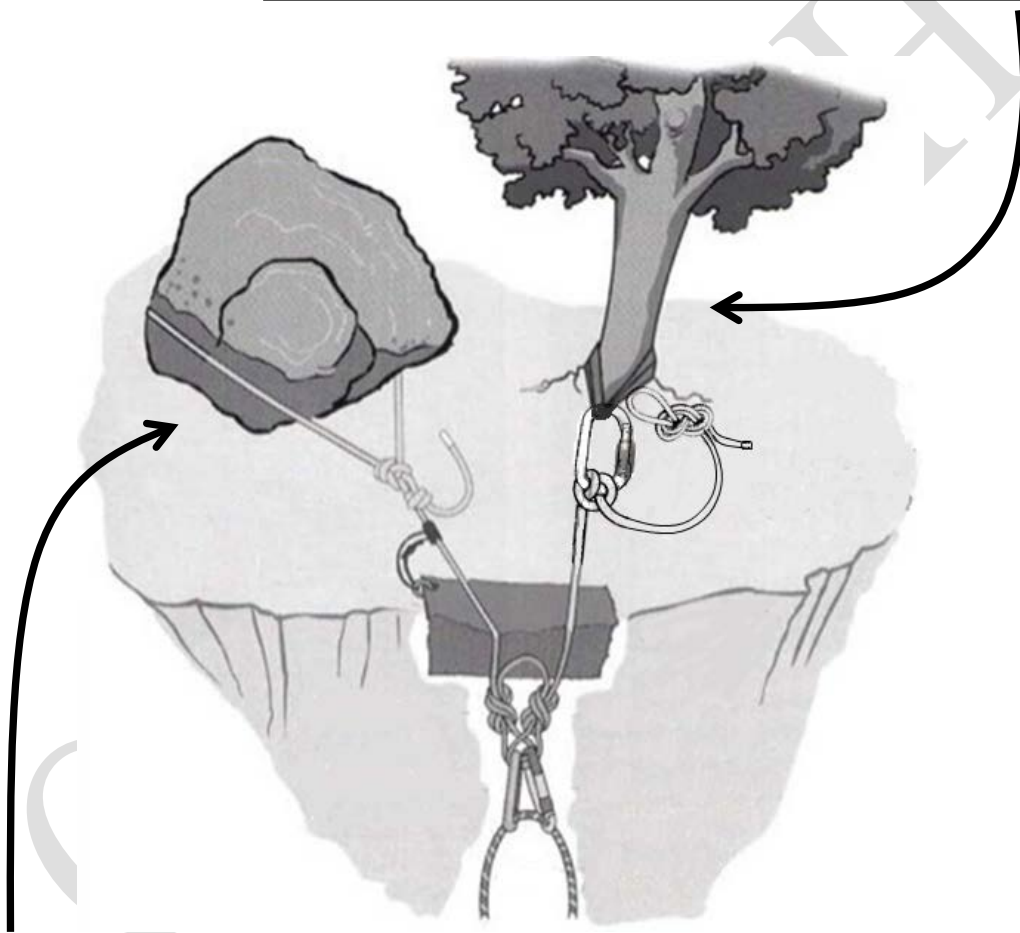
☐ Yes☐ No

If you answered 'yes' – explain:

- Q18. This question deals with natural anchors at a cliff site. Assume that there are no permanently installed anchors. A tree and a boulder has been selected and used to build an anchor system. Answer the questions below.

Minimum selection criteria for natural trees (when used as part of an anchor system)?

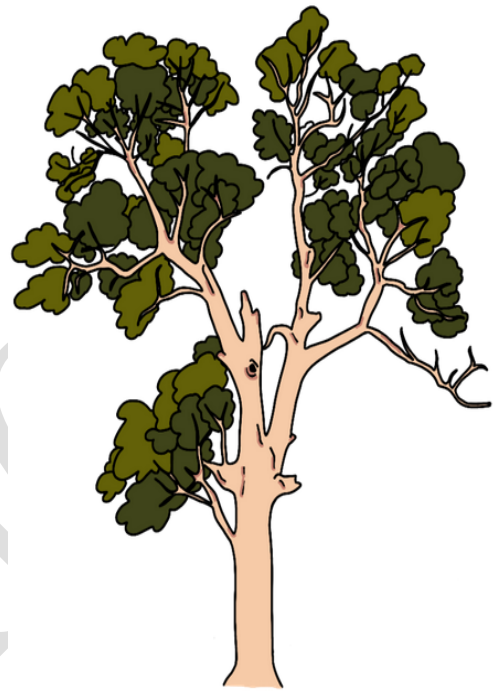
1	
2	
3	
4	
5	



Minimum selection criteria for natural boulders (when used as part of an anchor system)?

1	
2	
3	
4	
5	

- Q19. Natural trees are often used as anchor points for abseiling and climbing applications. For example, in canyoning activities a single tree is commonly used. If you are intending to use a solitary (single) tree as an abseiling anchor, what are the implications? Provide answers in the space provided below.



- Q19a. What are the considerations and implications for using a solitary (single) tree as an anchor?
Note: Consider what would happen if the tree failed!

Explain your answer:

- Q19b. Is it possible to rig the abseil rope so that no equipment or any trace is left behind? (this is known as 'ghosting').

☐

Yes

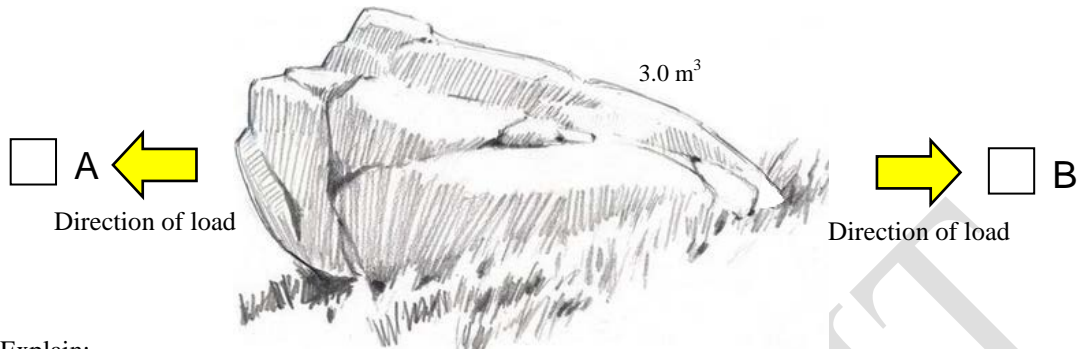
☐

No

Explain how no trace can be left behind:

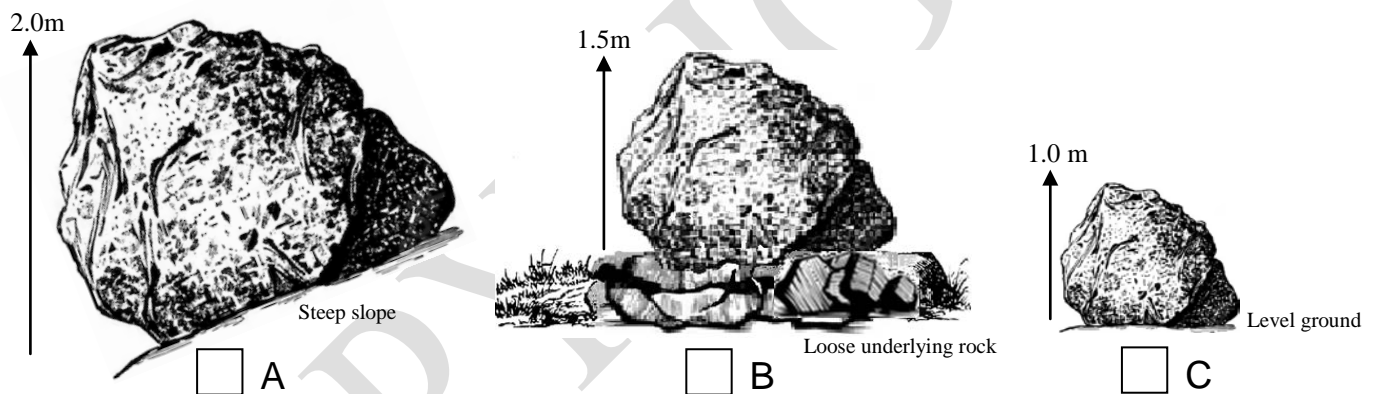
Q20. Study the images carefully. Each image is depicting a boulder with a certain geologic shape, position, and in-situ stability. Assume that all the depicted boulders are a solid mass of rock. Answer each of the questions below. **Note:** For comparison, 1.0m^3 of concrete weighs 2.3 metric tons.

Q20a. You have decided to use this boulder as an anchor point. Indicate the direction you would rig your rope/sling. Assume that the underlying ground is firm and stable.

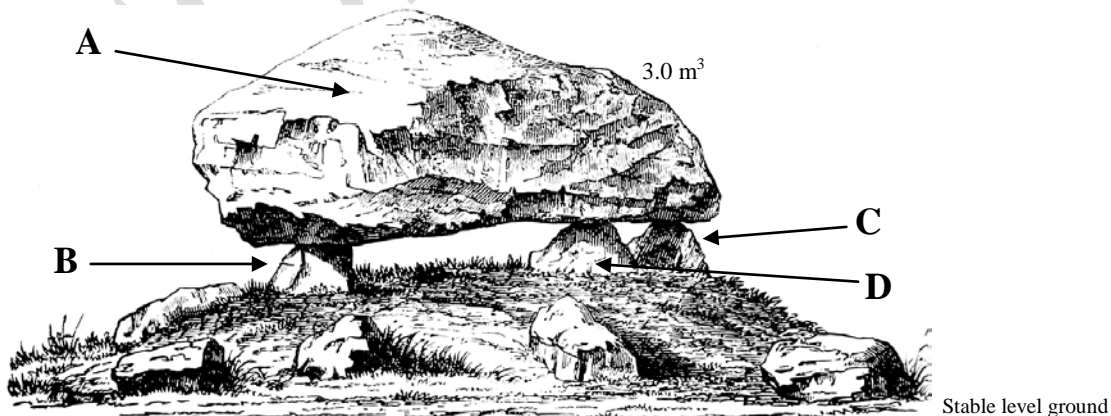


Explain:

Q20b. Indicate the boulder you consider to be most suitable for use as an anchor point. Assume that each boulder consists of a solid rock mass.



Q20c. Describe how this rock formation could be used as an anchor point. Assume the supported boulder is balanced and stable – and that the underlying ground is firm and stable. You may refer to the reference points 'A', 'B', 'C', and 'D' in your explanation.



Explain your answer:

- Q21. Study the images carefully. A 'chicken head' geologic feature is employed as an anchor point. Assume that the rock is solid and reliable. Indicate the method you believe is the most reliable and secure way of using a 'chicken head' (compared to the others).

☐ A☐ B☐ C

Q21a. Can you describe an alternative method of attaching to a 'chicken head'? Is your method better than the depicted images? Explain...

Q22. Compare and contrast the following devices.
Answer the questions below.



Q22a. Is 'A' inherently more reliable than 'B' ? ☐ Yes ☐ No

Q22b. Is 'B' inherently more reliable than 'C' ? ☐ Yes ☐ No

Q22c. Is 'C' inherently more reliable than 'D' ? ☐ Yes ☐ No

Q22d. Does 'C' provide a wider variety of placement options compared to 'A' or 'B' ? ☐ Yes ☐ No

Q22e. If the textile sling in 'A' wears out, can it be user replaced? ☐ Yes ☐ No

Hypothetical question:

If you could only choose one (1) type of device, which would it be? ☐

Why? Explain your answer:

- Q23. Study the images (A, B, C) carefully. Each image is a representation of an anchor system built from removable climbing protection devices. Assume each individual placement is optimal at time of insertion, and the surrounding rock is solid. When answering questions, consider the fact that under use, there will be some movement and that load is not perfectly shared / distributed between each protection device. When answering the questions, consider the difference between strength and reliability.



23a. Is it possible to posit that one anchor system is *inherently more* reliable? ☐ Yes ☐ No

If yes, which one? ☐ A ☐ B ☐ C

23b. Is it possible to posit that one anchor system is *inherently less* reliable? ☐ Yes ☐ No

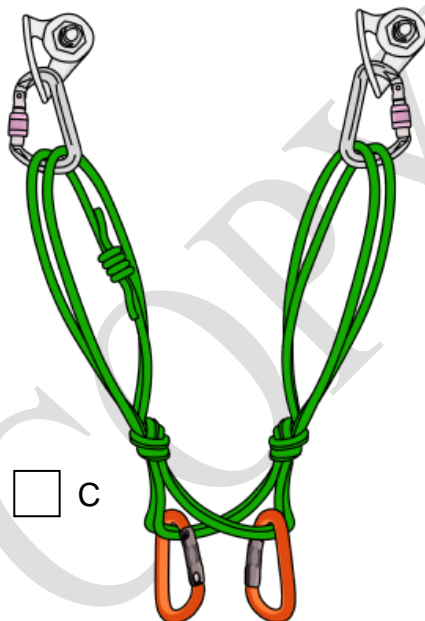
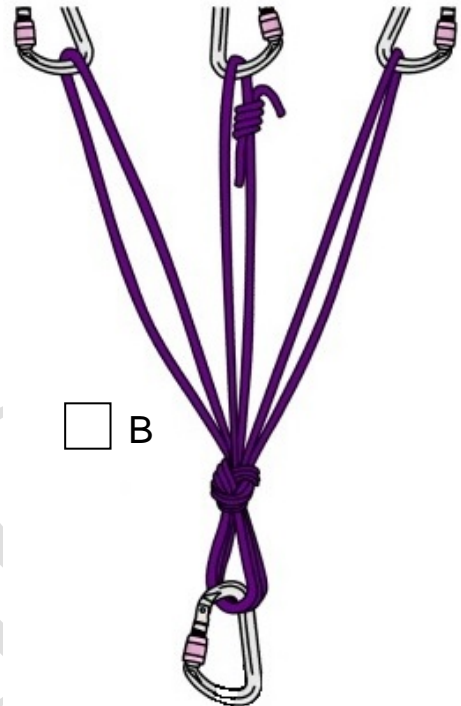
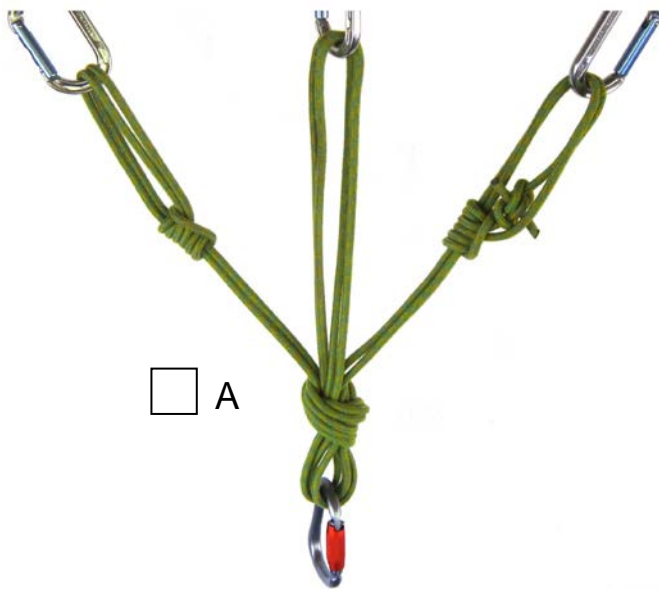
If yes, which one? ☐ A ☐ B ☐ C

23c. In consideration of A, B, and C, is one system more susceptible to the effects of movement / jiggling?

☐ A ☐ B ☐ C

Explain your answers:

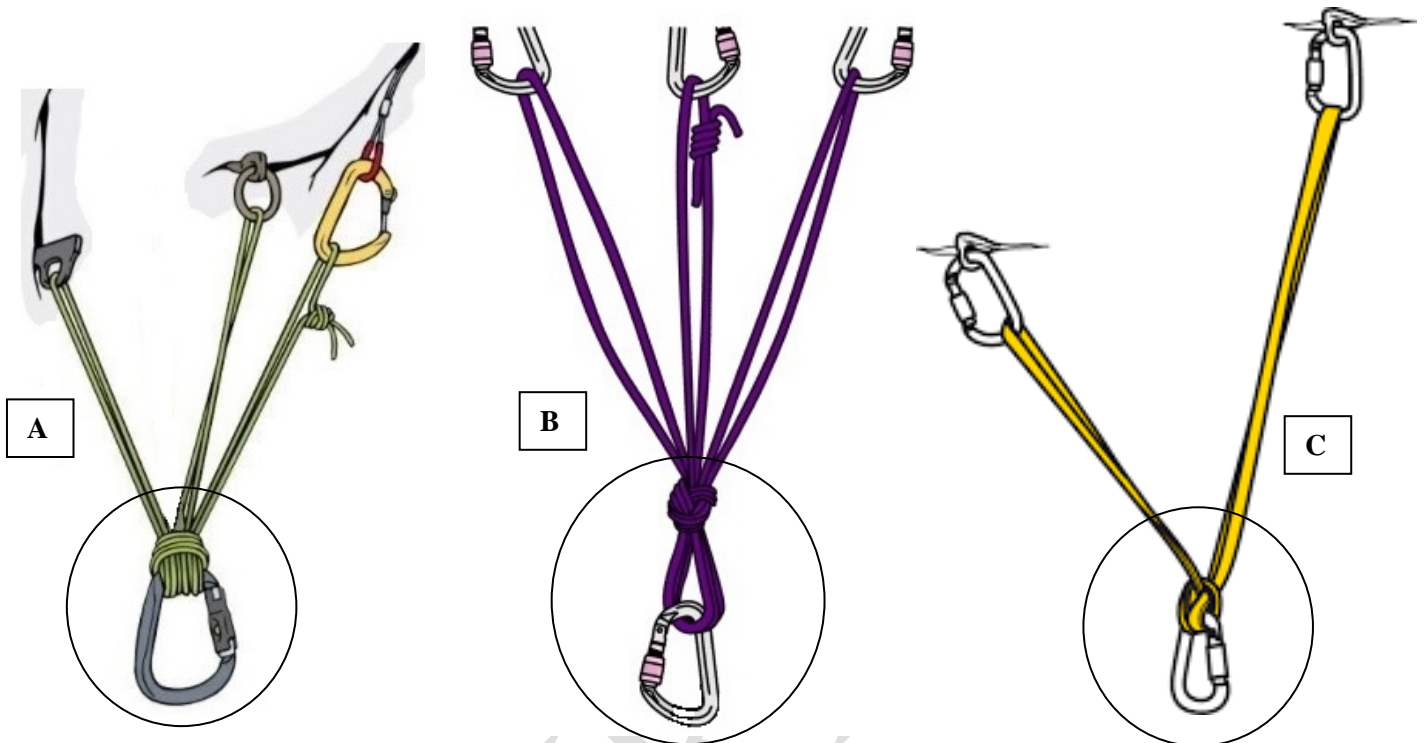
- Q24. Study the images carefully.
Each anchor system is built from a 'cordalette' (using EN564 accessory cord).
Choose the anchor system you believe provides the best combination of 'no single point of failure', load sharing, reliability, ease of configuration, and adjustability/alignment. Assume that individual anchor points are identical in each photo. You will be required to explain your answer.



Explain your answer:

Q25. Study the images carefully. Each anchor system is built from a length of accessory cord ('cordalette') or webbing. Look closely at the focal points of each anchor – they are formed differently. Assume that each setup is equally strong and reliable.

Note: In the USA, the focal point is known as a 'master point'.



25a. Which configuration do you consider to be more effective?

☐ A ☐ B ☐ C

25b. Which configuration do you consider easiest to equalise (load sharing)?

☐ A ☐ B ☐ C

25c. Which configuration do you consider to be more optimal for rescues?

☐ A ☐ B ☐ C

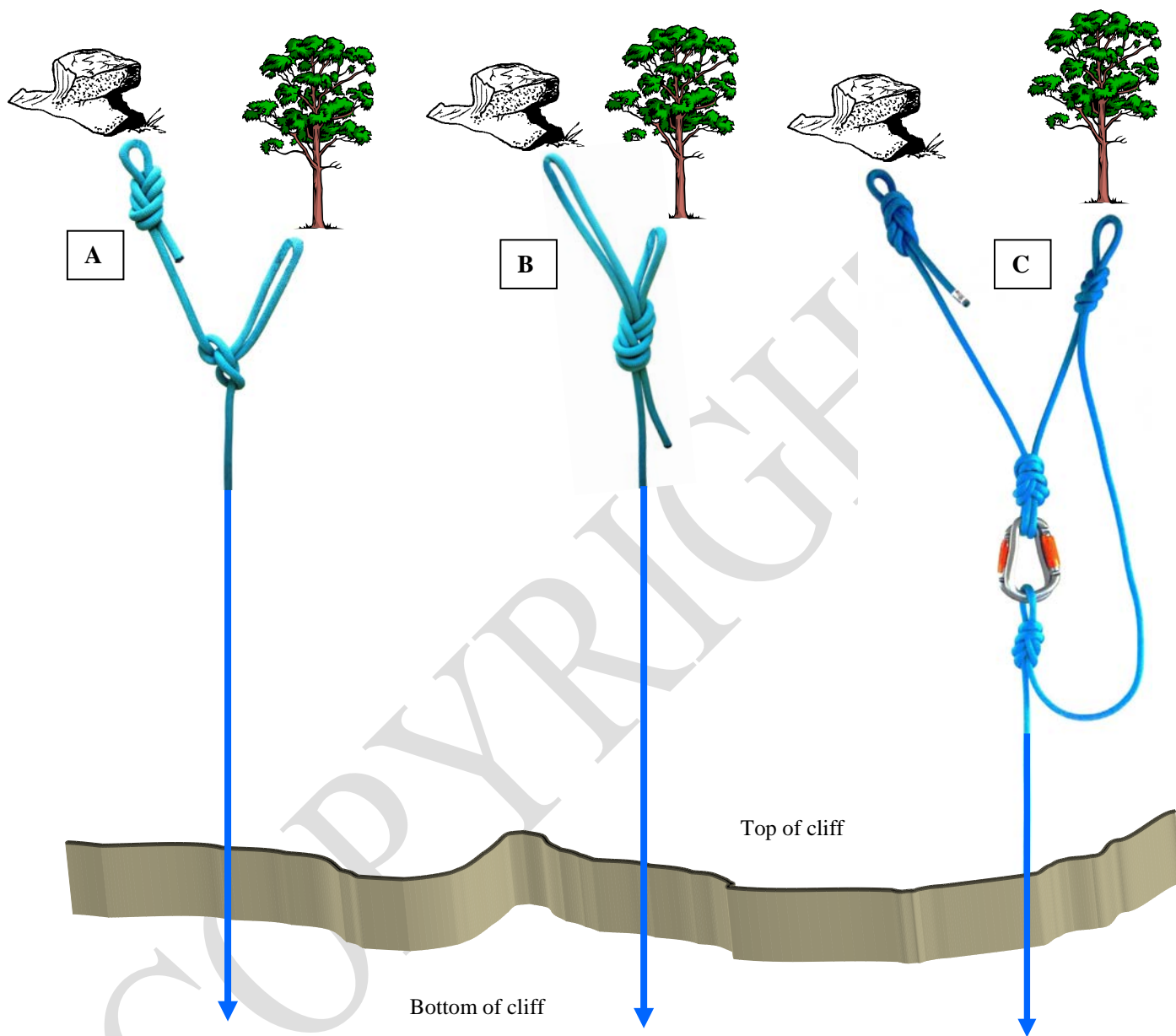
25d. Which focal point configuration is more fault tolerant in case of the loss of a single load segment (eg due to cutting caused by contact with a sharp edge)?

☐ A ☐ B ☐ C

25e. Most people have a strong tendency to stick with one method that they know is effective and is user friendly to configure. For the purposes of answering this question, it is assumed that you prefer one type of configuration. Summarise why you believe one configuration meets all of your personal requirements better than the others.

Explain your answer:

- Q26. Study the images carefully. Each setup is for an abseiling activity. Assume that the anchor points are solid and reliable, and all knots are tied correctly. Assume that the rope is fit for purpose.
 Note: Images are not a precise representation of actual lengths and distances due to camera optics.
 Answer each of the questions below.



26a. Which anchor setup do you consider to be the most efficient use of resources?

☐ A ☐ B ☐ C

26b. Which anchor setup maximises the available rope length (to enable a longer abseil descent)?

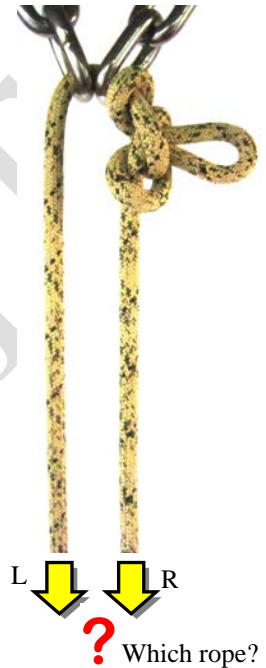
☐ A ☐ B ☐ C

26c. Which anchor setup do you consider to be the most technically complex to configure?

☐ A ☐ B ☐ C

26d. Are all of the anchor setups safe to use, and what do all of the setups *have in common*? Explain:

- Q27. Study the images carefully. You only have one (1) available rope, and you need to be able to retrieve your rope after completing an abseil descent. Another factor is that you only have a cam assisted self-locking belay device (a GriGri – which can only accept 1 rope). Assume that you don't know how to tie and use an Italian hitch (aka Munter hitch). Choose the configuration that you believe is optimal for this situation. You will be required to explain your answer.

☐ A☐ B☐ C☐ D☐ E

Explain your answer:

Final 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 area of anchor systems. I further understand and acknowledge that anchors systems are fundamental to all outdoor adventure activities that involve ropes and height. I acknowledge that my health and safety, and the safety of others may depend on my ability install a solid and reliable anchor system.

Student signature: _____

Date: _____