Candidate:_____ Date: _____

LEAD CLIMBING DIAGNOSTIC EXAM (core exam) **Recommended 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 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 of others. Competency can be demonstrated by initially scoring 100%.

Legal disclaimer: This exam paper and the content herein is not intended as a substitute for competent training from a very experienced lead climbing instructor. It is not possible to write down and articulate all of the salient concepts of how to safely lead climb in all situations. Some physical, emotional, and technical concepts of lead climbing can only be gained from personal experience in real-world climbing adventures (tacit knowledge). The concepts in this exam paper are written down to elicit thought and develop your explicit knowledge. Practical application of your knowledge will occur while leading various routes under the close supervision and control of your instructor.

Q1. Define lead climbing. What does this mean exactly?

Explain:

Q2. Is there a difference between *sport* lead climbing and *trad* (traditional) lead climbing?

Explain what 'sport' lead climbing is:

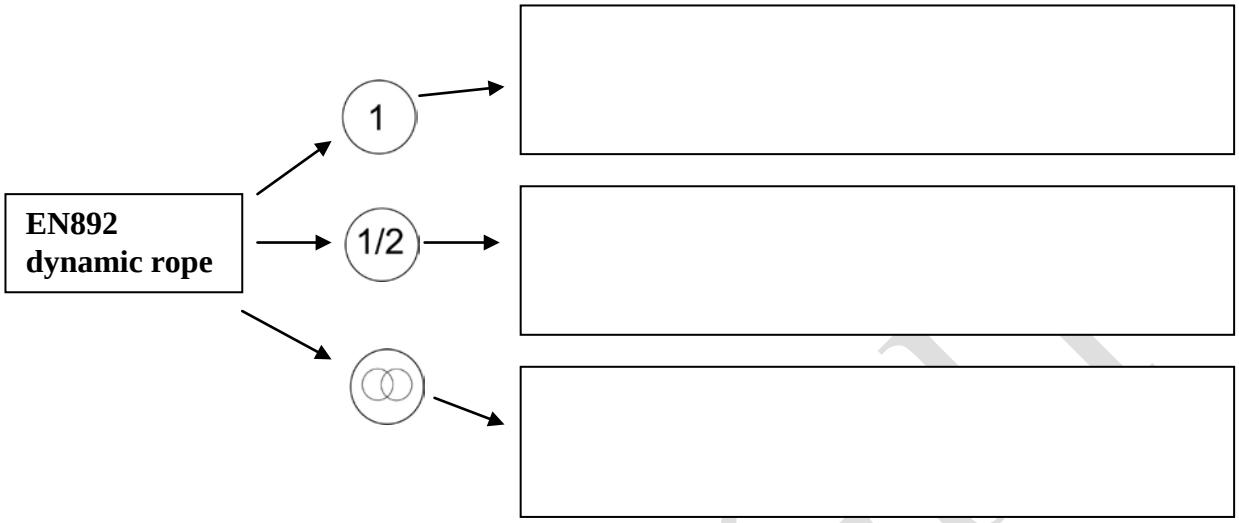
Explain what 'trad' lead climbing is:

Q3. Explain what is meant by 'single-pitch' lead climbing:

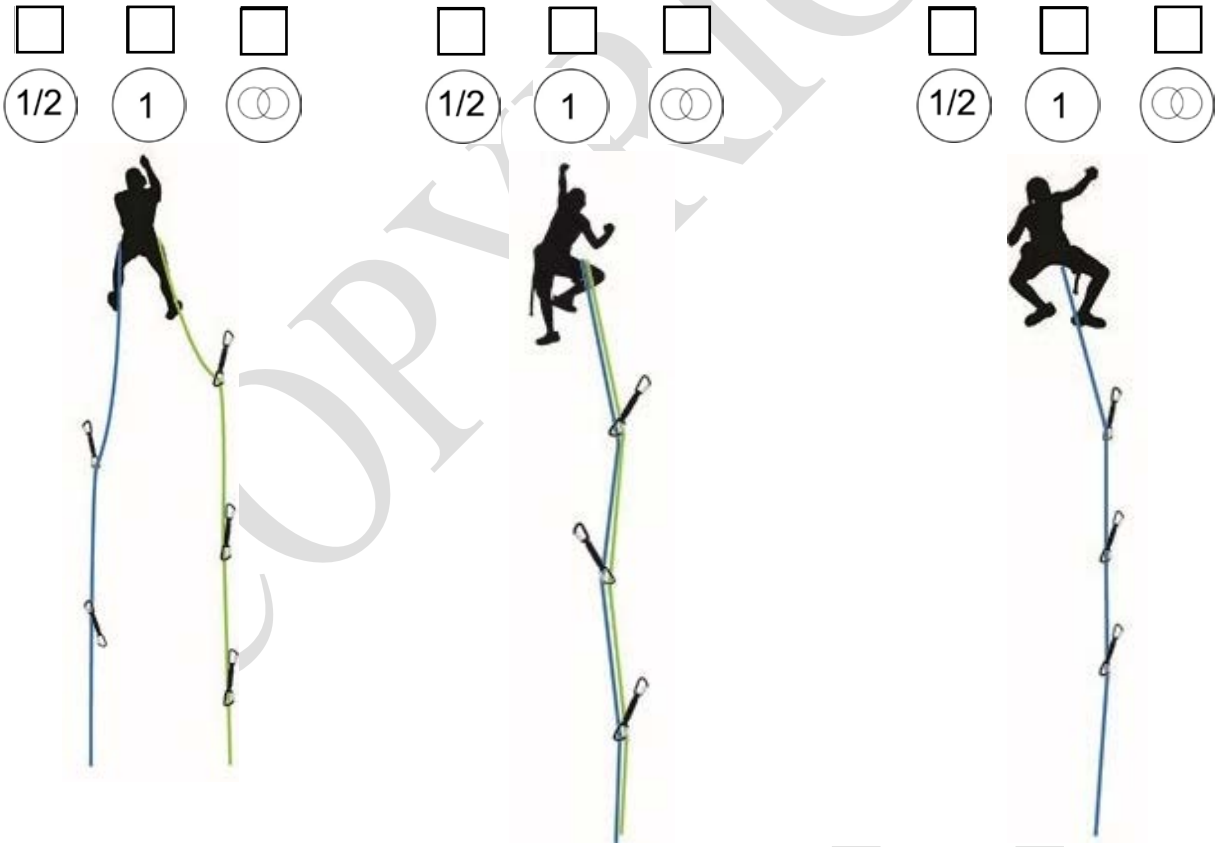
Q4. In consideration of the previous question, explain what is meant by 'multi-pitch' lead climbing (compare and contrast multi-pitch against single-pitch):

COPYRIGHT

Q5. EN892 is the default world standard for manufacturing dynamic climbing ropes. This standard describes three different categories of dynamic rope. Describe how each category is <u>tested</u> in the box provided.



Q6. Study the images carefully. Identify the symbol that applies in each case.



Q7. Can abseiling rope (EN1891) be used for lead climbing? Yes ☐ No ☐

Explain your answer:

COPYRIGHT

Q8. Explain what the term "fall-factor" means. Your answer must also include the fall factor formula. Describe your answer.

Q9. The fall-factor generated by a standard EN 892 test fall is (or UIAA 101):

A ☐ 1

B ☐ 1.78

C ☐ 2

D ☐ None of the above

Q10. What is the fall-factor for the following examples of falls?

i) Climber falls a distance of 6m with 10m of active rope out _____

ii) Climber falls a distance of 4m with 2m of active rope out _____

iii) Climber falls a distance of 8m with 20m of active rope out _____

Q11. Study the images and information. From the range provided, which rope would you choose for lead climbing? Assume you are a novice lead climber. Indicate your answer. You will be required to explain your answer. Note: All ropes are the same length (60m).

A ☐

B ☐

C ☐

Specifications
EN892
Diameter [mm]: 10.3
Number of falls: 9
Impact of force [kN]: 9.1
Dynamic elongation [%]: 33
Weight [g/m]: 68 g
Core proportion [%]: 64.00
Sheath proportion [%]: 36.00
Static elongation [%]: 8
CE marking: CE 0123
Country of origin: Germany
Single Rope: Yes
Half rope: No
Twin Rope: No

Specifications
EN892
Diameter [mm]: 9.1
Number of falls: 5 (single), 20 (half)
Impact of force [kN]: 8.2 (single), 6 (half)
Dynamic elongation [%]: 34 (single)
Weight [g/m]: 52 g
Core proportion [%]: 64.00
Sheath proportion [%]: 35.00
Material: polyamide
Country of origin: France
Single Rope: Yes
Half rope: Yes
Twin Rope: Yes

Specifications
EN892
Diameter: 7.7 mm
Number of falls: 7 (half), 20 (twin)
Impact force [kN]: 6 (half), 10 (twin)
Dynamic elongation: 31 % (half), 28 % (twin)
Weight [g/m]: 40 g
Percentage of sheath: 36 %
Static elongation: 8.5 % (half), 6 % (twin)
Construction: 48 carrier
Material(s): nylon
Single Rope: No
Half rope: Yes
Twin Rope: Yes

COPYRIGHT

Q12. The theoretical maximum fall-factor that can be generated by a lead climbing fall is:

A ☐ Factor 1

B ☐ Factor 1.78

C ☐ Factor 2

D ☐ None of the above are correct

Q13. Generally, lead falls that occur near the end of a pitch will generate:

A ☐ A lower impact force because there is more rope available to absorb energy

B ☐ A higher impact force because there is less rope available to absorb energy

C ☐ A lower impact force because there is less rope available to absorb energy

D ☐ A higher impact force because there is more rope available to absorb energy

E ☐ None of the above are correct

Q14. Describe the 'zipper effect' and how to avoid it. There are 2 parts to this answer:

"The zipper effect is….

"Can be avoided by….

Q15. What is 'rope drag' is and how can it be avoided? There are 2 parts to this answer:

"Rope drag is…

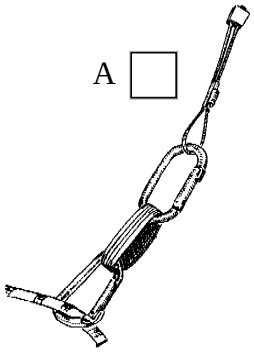
"Rope drag can be avoided by…

Q16. A person has asked; *"How do you determine the amount and type of protection devices to carry (eg on your harness) when preparing to lead a route on-sight"*. The person noticed that other climbers *"just seem to know what to take"*. Explain your answer.

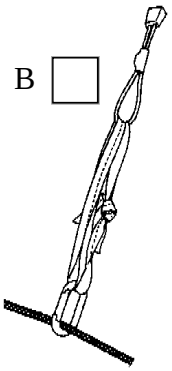
COPYRIGHT

Q17. Indicate the diagram that best matches how you would attach your rope to removable protection.

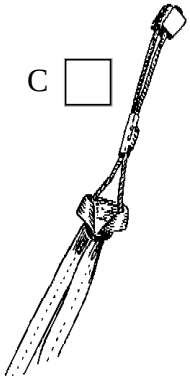
A ☐



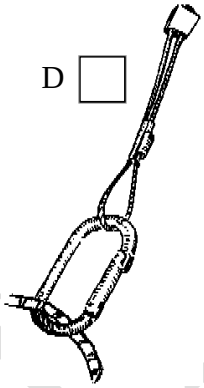
B ☐



C ☐



D ☐



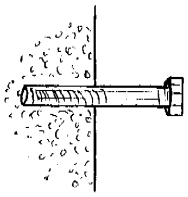
Q18. Study the images carefully. What are these devices and what are they used for?
Are some designs better than others?

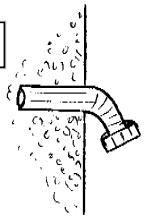
What are these devices? _____

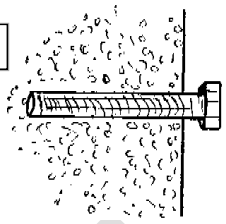
What are they used for? _____

Describe the procedure to use the device effectively (including how to avoid dropping it):

Q19. Which of the following drive-in (carrot) bolts would you <u>avoid</u>? (more than one answer may be indicated)

A ☐ 

B ☐ 

C ☐ 

Q20. This question deals with 'carrot' bolts – which are still found and used at some Australian climbing areas. The photo sequence shows a bolt bracket fitted on the 'carrot' bolt - and then a quick-draw sling is attached. Answer the questions below...

Q20a. What stops the bolt bracket from simply slipping off the carrot bolt?

_____

Q20b. Does the physical size (diameter and shape) of the carabiner affect the security of the bolt bracket attachment?

No ☐ Yes ☐

Explain your answer:

Q20c. What is the preferred method of carrying loose bolt brackets – so they can be easily and quickly accessed (with one hand)?

Q20d. Why were carrot bolts used (ie installed)? What is the likely underlying reason for their use?

COPYRIGHT

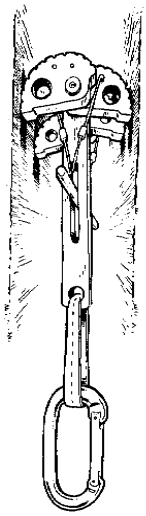
Q21. Lead climbers should place removable protection devices more frequently at the start of a route. There are two (2) primary reasons for this. Describe your answers.

(1)

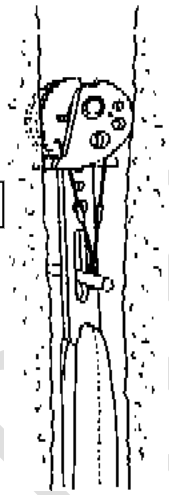
(2)

Q22. Study the diagrams carefully. Describe the condition of the cams in terms of the extent to which they are contracted/extended. Write your response in the space provided:

A ☐



B ☐



I would describe the cam in diagram A as _____

I would describe the cam in diagram B as _____

Q23. When inserting a camming unit (eg, a 'Friend' or 'Camalot') into a crack, it is important to:

A ☐ Align the shaft in the direction of the anticipated fall

B ☐ Ensure that all cams are balanced and in contact with the rock on both sides

C ☐ Avoid under, or significantly over expanded cams

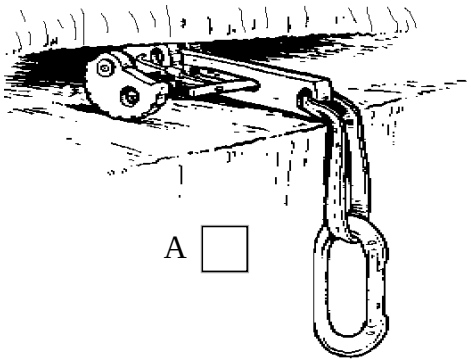
D ☐ Try to prevent the cam from 'walking' further into the crack

E ☐ Ensure all of the above

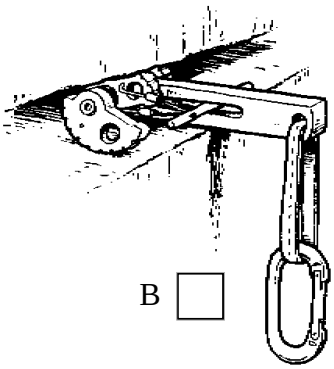
Q24. The risk of a cam 'walking' (inside a crack) is an ever present risk that must be managed by a lead climber. What actions can a lead climber take to minimise the risk of a cam 'walking'? Explain...

COPYRIGHT

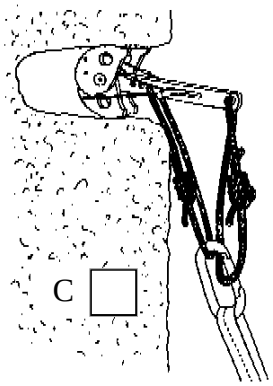
Q25. Which diagram would you regard as being the <u>most secure and stable</u> placement for a rigid stem cam in a horizontal break? Assume the rock is solid and that the force is directed downwards.



A ☐



B ☐



C ☐

Explain your answer:

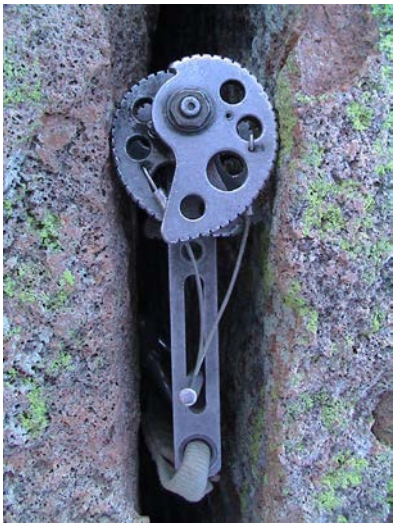
Q26. Study the photo carefully. Provide a reasonable explanation of how the rigid stem cam failed.

Explanation of likely failure mechanism:

Are rigid stem cams still being manufactured and sold to the public? Yes ☐ No ☐

Explain your answer:

Q27. Which cam would you regard as being the <u>most secure</u> placement? Assume the rock is solid and that the force is directed downwards.



A ☐

B ☐

C ☐

Explain your answer:

Q28. Study the photo carefully. Answer the questions in the space provided. Assume the rock is solid and that the force is directed downwards.

28.1 What type of crack is the cam inserted in? Describe:

28.2 Will this be a secure cam placement?

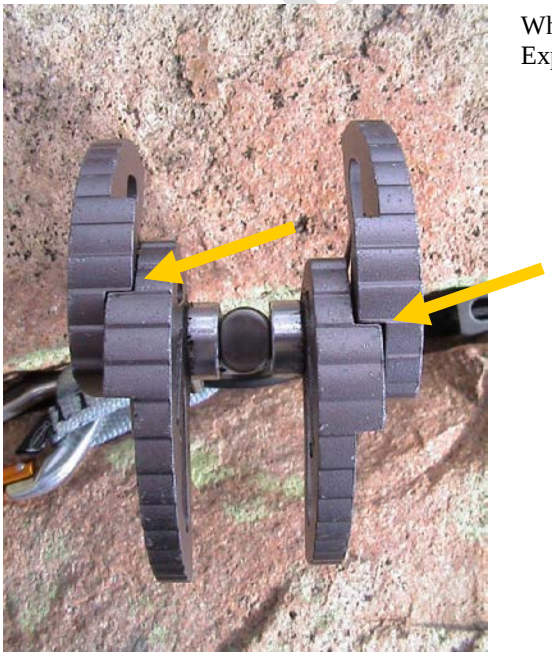
Yes ☐ No ☐

Explain your answer:

Q29. Study the photos carefully. This question relates to the previous question. Do you notice anything about the comparative size of the cam lobes?
These types of cam designs are intended to be placed in what type of crack? Would this type of design be more effective than a regular type of cam in the intended application?

Explanation:

Q30. Study the photo carefully. What is the purpose of the segment of the cam indicated? Write your answer in the space provided:



What is the purpose of this particular part of the cam?
Explain your answer...

Q31. Describe the advantages and disadvantages (if any) that exist between 3 cam units (TCU) and 4 cam units. Write your answers in the space provided:

31.1

"Advantages of 3 cam units are…

"Disadvantaged of 3 cam units are…

31.2

"Advantages of 4 cam units are…

"Disadvantaged of 4 cam units are…

Q32. Study the photos carefully. Choose the photo that you would consider being the most secure wire placement. Assume the rock is solid in all photos. Force is directed downwards.

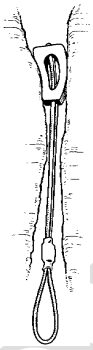
A ☐ 

B ☐ 

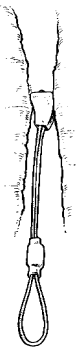
C ☐ 

Explain your answer:

Q33. Study the wire placements carefully. Choose the diagram that you would consider being the most secure placement. Assume the rock is solid and the force is directed downward.

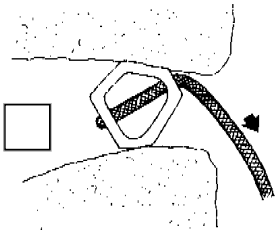
A ☐ 

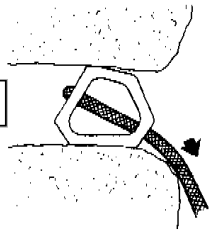
B ☐ 

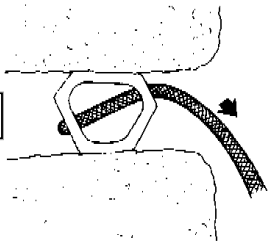
C ☐ 

Explain your answer:

Q34. Study the hex placements carefully. Indicate the diagram that you would consider being the most secure placement.

A ☐ 

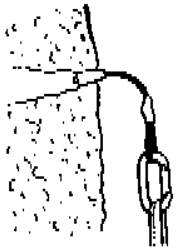
B ☐ 

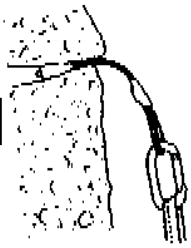
C ☐ 

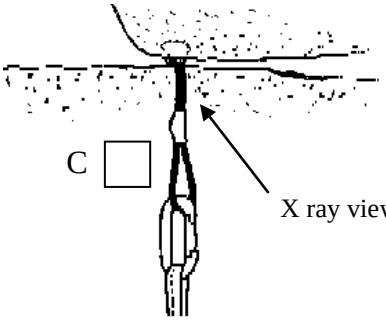
Explain your answer:

COPYRIGHT

Q35. Study the diagrams carefully. Choose the diagram that you would consider being the most secure placement. Assume that the rock is solid. Diagrams show cross-section and X-ray views. Force can be downward or outward.

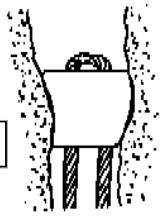
A ☐ 

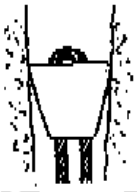
B ☐ 

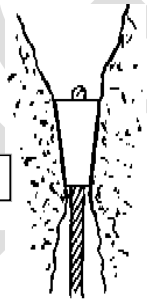
C ☐ 

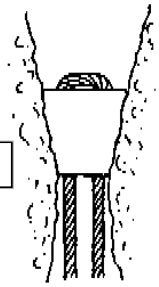
Explain your answer:

Q36. Study the diagrams carefully. Choose the diagram that you would consider being the **least secure** wire placement. Assume the rock is solid and the force is directed downward.

A ☐ 

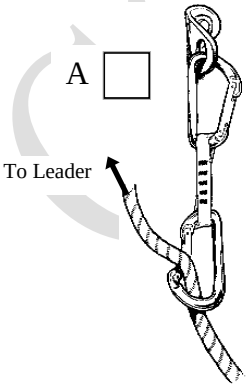
B ☐ 

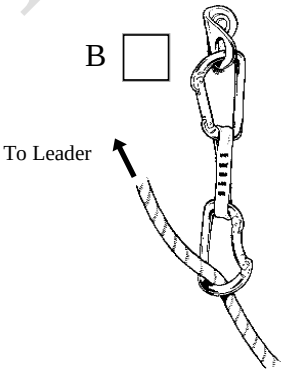
C ☐ 

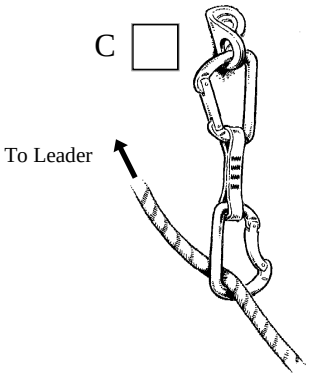
D ☐ 

Explain your answer:

Q37. Indicate the diagram that demonstrates how you would prefer to orient your quick draws/carabiners when leading a traverse or moving diagonally.

A ☐ 

B ☐ 

C ☐ 

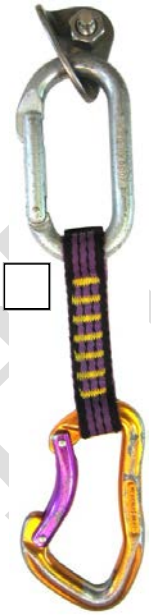
Explain your answer:

Q38. Study the images carefully. Note the different orientations of the carabiners on the quick-draw sling relative to the fixed protection (ie bolt). Choose the configuration you think provides the best combination of security and risk reduction. You will be required to explain your answer...

A ☐ 

B ☐ 

C ☐ 

D ☐ 

Explain your answer:

Q39. Study the images carefully. Choose the image you believe indicates the safest method of linking your rope to fixed protection. You will be required to explain your answer...

A ☐ 

B ☐ 

C ☐ 

Explain your answer:

Q40. Which type of harness is best suited for lead climbing (trad routes)? Choose from the range provided below...

A ☐ B ☐ C ☐ D ☐

Q41. Study the images carefully. Removable protection devices need to be carried while climbing a route. The carriage and arrangement of gear is known as 'racking' (ie the gear needs to be racked). Are there any advantages of one design type over another? Choose a design type that you believe is effective.

A ☐

B ☐

C ☐

D ☐

Explain your answer:

Q42. TRUE or FALSE

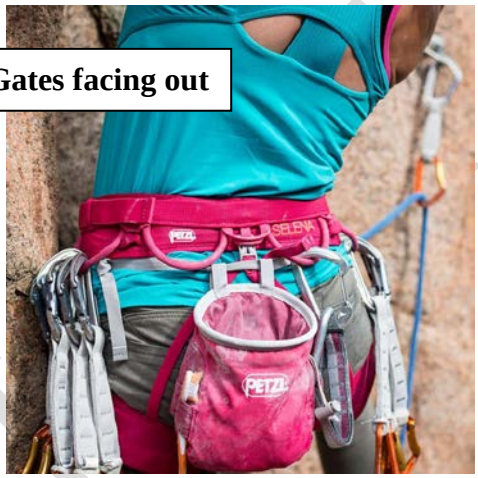
The arrangement of protection devices and quick-draws in terms of how they are carried (in preparation for lead climbing) is <u>not</u> important.

☐ True ☐ False

Q43. A decision that all lead climbers must make is whether to orient carabiners with gates facing *inwards* or *outwards*. Is there a preferred orientation? How is the optimum orientation determined?

Gates facing in

Gates facing out



Explain your answer...

Q44. Wired nuts are considered to be fundamental protection – and are essential for trad climbing.

Q44a. What is the most effective/efficient method of <u>carrying</u> wired nuts so they can be quickly and easily accessed (with one hand)?

Explain:

Q44b. Is there a <u>limit</u> as to how many wired nuts can be carried on a single carabiner?

☐ Yes ☐ No Explain:

Q44c. Is there a preferred <u>type of carabiner</u> upon which to carry the wired nuts?

☐ Yes ☐ No Explain:

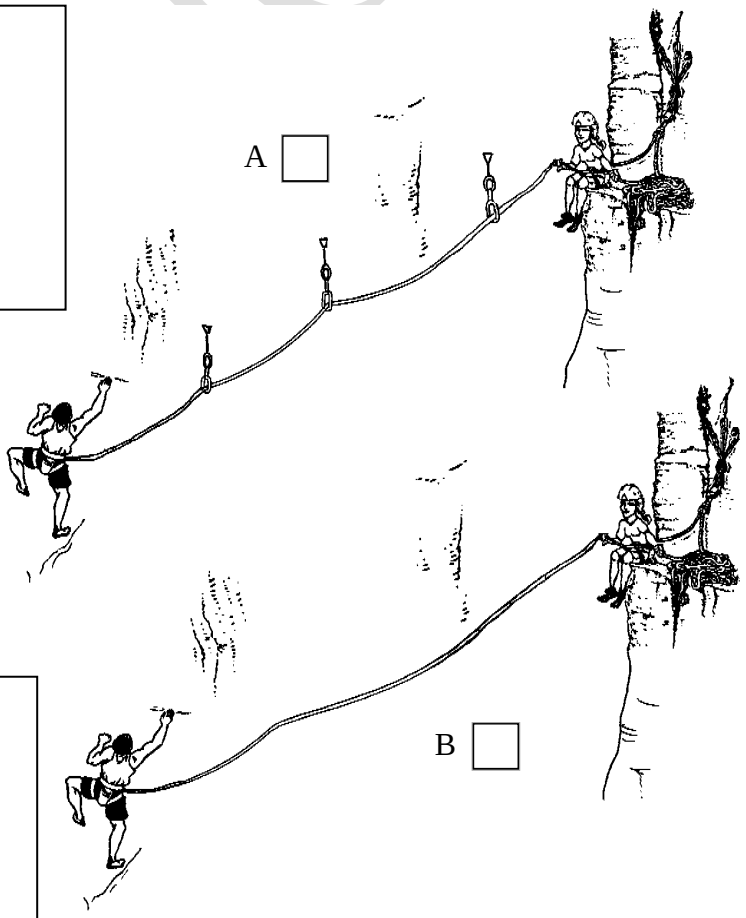
Q45. Explain the considerations and preparations between leading a route that has already been established and published in a guide book in contrast to leading a route that has never been climbed before (ie, attempting to lead a new route on-sight).

45.1 Considerations/preparations for leading route that has already been established:

45.2 Considerations/preparations for attempting a new route that has never been climbed before:

Q46. The following diagrams refer to a traverse section of a climb. Indicate the diagram which you consider to be the most correct. Explain your answer.

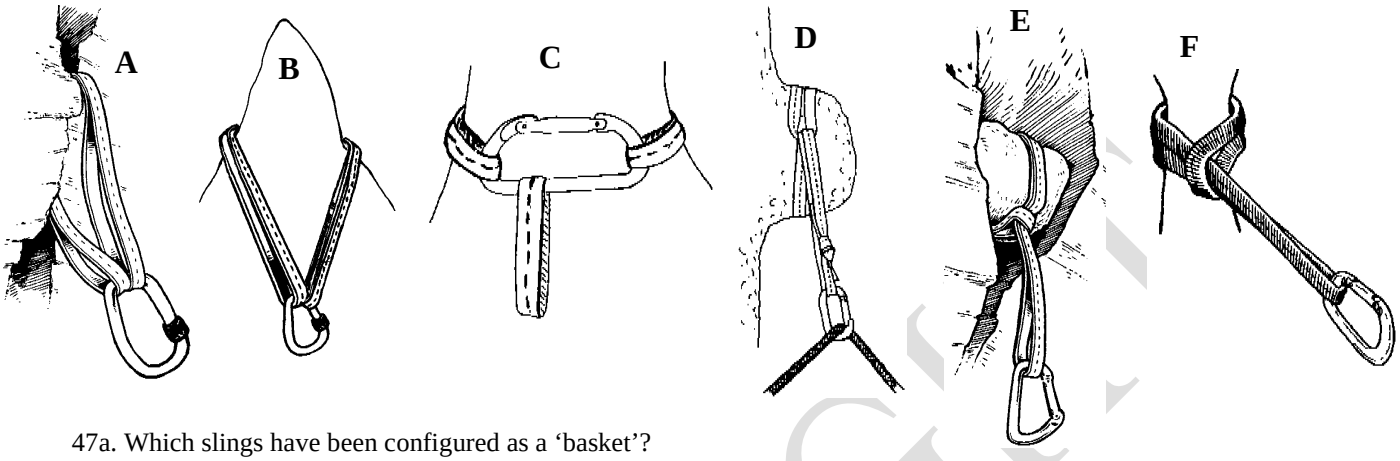
Explanation of diagram A:



Explanation of diagram B:

COPYRIGHT

Q47. Study the following diagrams carefully. Some slings are configured as a 'basket' while others are configured as a 'girth hitch' (also known as a choke). Answer the questions below...
Note: Assume that the rock is solid in each diagram and that the rock continues in all directions (for clarity, only a small section of rock is drawn to illustrate the concept).



47a. Which slings have been configured as a 'basket'?

A ☐ A B C

B ☐ D E F

C ☐ B only

D ☐ None of the above are correct.

47b. Which slings have been configured as a 'girth hitch' (ie choked)?

A ☐ A B C

B ☐ D E F

C ☐ D only

D ☐ None of the above are correct.

47c. Study diagram 'D'. Why is the sling offset to one side?
Explain your answer:

47d. If you girth hitch (ie choke) a sling, does this *weaken* the sling to the point where it will likely catastrophically fail if you fall?

☐ Yes ☐ No

Explain your answer:

COPYRIGHT

Q48. Explain the meaning of each of the following climbing terms:

On-sight flash:

Flash:

Red point:

Q49. This question relates to the *previous* question. Why do climbers attempt to make a distinction between the different 'styles' of ascent? Is it important to make such a distinction when you have led a route – particularly a new route? Who might benefit from such information?

This question will also serve as a discussion point with your instructor...

Explain your answer:

Q50. This question is about the Australian system of grading. Who designed the Australian grading system and what limitations/shortcomings (if any) are there in its application. Explain your answer.

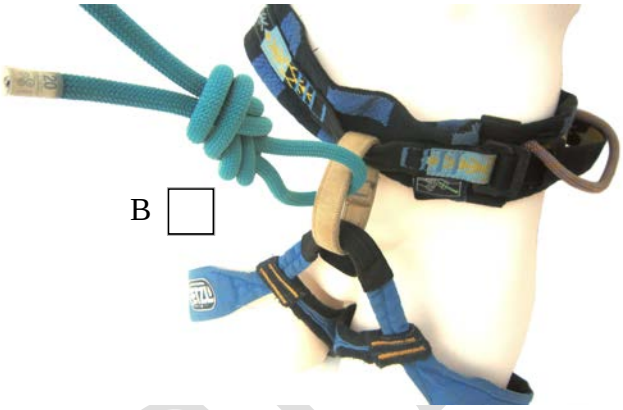
Who designed/invented the Australian grading system?

Limitations of Australian grading system? (explain/discuss)

Q51. Study the diagrams carefully. You are preparing to *lead* a route from the ground up. Select the image that you consider is a secure and stable method of attaching your rope to a climbing harness. Explain your answer. For the purposes of this question, assume all hand tied knots are correctly tied.

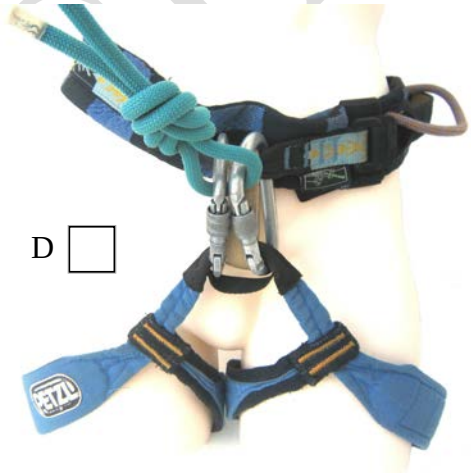
A ☐

B ☐



C ☐

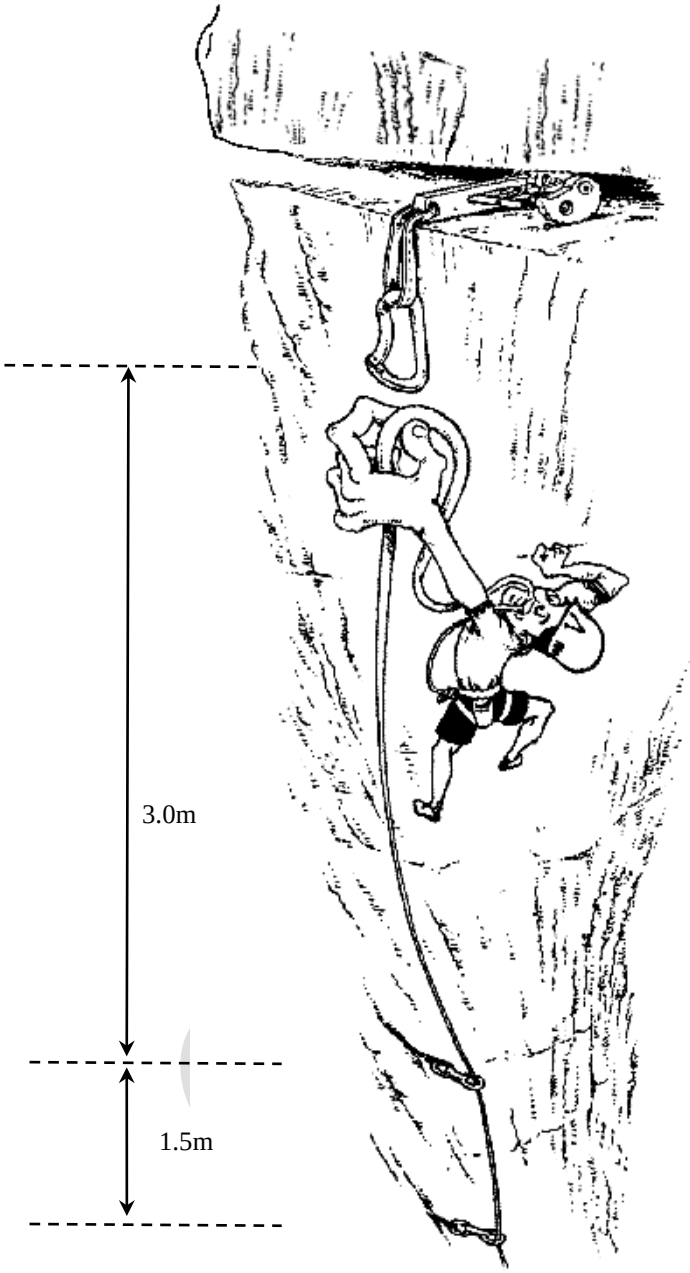
D ☐



E ☐

Explanation:

Q52. Study the image carefully. You have placed a cam and will now attempt to clip your rope into that protection. You are climbing with a <u>single</u> rope that is managed by a competent belayer. Answer each of the questions where indicated...



52a. Why is the climber holding the rope in his teeth? Is that a safe thing to do? Is there any way to avoid using teeth?
Explain your answer...

52b. If the climber misses the clip and falls, how far will he fall?

A ☐ 3.0m

B ☐ 6.0m

C ☐ 6.0m plus the amount of slack drawn up

D ☐ 4.5m

E ☐ None of the above are correct.

Explain your answer...

52c. Is there anything the belay person can do to minimise the fall potential (eg in case the climber misses the clip and falls)? Explain your answer...

Q53. Study the image carefully. You are lead climbing on a single-pitch 'trad route' using a single rope. What type of belay device would be best suited for this type of situation? Choose from the range of belay devices shown below. You will be required to explain your answer (ie justify your answer)...

?

A ☐

B ☐

C ☐

D ☐

Explain your answer:

COPYRIGHT

The remaining questions attempt to gauge your judgement about various issues when leading a route or instructing others. There is no specific right or wrong answer. Your choices will serve as a discussion point and will enable your instructor to gauge your level of understanding about lead climbing.

Q54. Conceptual question 1). How frequently should you place removable protection devices while leading? What are the key factors that determine *how frequently* a climber places gear? Write a key descriptor in the space provided next to each sentence to indicate the level of importance you believe it has:

Use the following descriptors: [Not important], [Important], [Very important]

Descriptor (write a the descriptor that best matches your preference)

_____ The presence of a group of people observing the climbers performance

_____ Current position relative to the ground and any ledges below

_____ Climber familiarity with route (eg, prior rehearsals)

_____ Type of rock (eg, granite, sandstone, limestone, etc,.)

_____ Fear of falling

_____ Amount of protection devices remaining to complete route (running out of gear).

_____ Climber ability (experience level)

_____ Whether single or double rope technique is used

_____ Technical difficulty (grade) of route

_____ Approaching darkness (getting late in the day)

COPYRIGHT

Q55. Conceptual question 2). When attempting to lead a route, there are some important factors that should be considered before actually placing a removable protection device. What are the key factors that determine whether a climber would actually place protection at any given position? Write a key descriptor in the space provided next to each sentence to indicate the level of importance you believe it has:

Use the following descriptors: [Not important], [Important], [Very important]

Descriptor (write a the descriptor that best matches your preference)

_____ Rapidly fading strength ('pumping out') while hanging around trying to get gear in.

_____ Whether there will be any arising rope drag

_____ Current height above ground

_____ Current position relative to any ledges below

_____ Distance remaining to reach the top or next belay position (ledge)

_____ Distance out from belayer

_____ Inability to use the crack once a piece has been inserted

_____ The relative strength and quality of the rock immediately surrounding the device

_____ Possibility of ground-fall

_____ Placing too much gear reveals your fear and anxiety and demonstrates weakness in front of others

Student statement:
I declare that I completed this exam paper without the assistance of others. I acknowledge that my knowledge and skill as a lead climbing could impact upon my safety including the safety of others. I accept that I may owe a duty of care to others while climbing or instructing others and that if I fail to discharge my duty, I could face legal consequences. I further accept and agree that I have a duty to maintain my knowledge and skills through regular practice, including my rescue skills.

Student signature: _____ Date: _____

Final score _____ (competency = 55/55)

COPYRIGHT

The following question is for lead climbing instructors only…

Q56. You are the senior lead-climbing instructor contracted to teach a group of two students. The students want to learn how to safely lead single-pitch routes on natural rock. They have never experienced lead climbing before. They have previously enrolled in abseiling and top-rope climbing classes with a different instructor in another State. You have no prior personal experience with the students. Carefully read each statement then rank each response in order of preference.

(1 indicates that you believe it is the 'best' approach, 5 indicates the 'worst' approach).

RANK

___ I would not demonstrate any techniques. Students learn best through their own experience. On their first lead climb, I would allow them to climb without any backup safety systems such as a top-rope. They have got to get used to the idea of leading and the only way to do it is to let them go for it. I would monitor their progress from the ground.

___ I would not use a safety backup system such as a top-rope but I would ascend a fixed rope immediately adjacent to the students in order to closely monitor their progress. If they get into trouble, I would immediately clip a lanyard to their harness to catch them if they fall.

___ I would have the students second me on a few routes first then let them try their first lead but with the security of a top-rope system. Once they have demonstrated competency in the basic principles, I would remove the top-rope. I would ascend a fixed rope adjacent to the students during their first lead to offer advice and feedback.

___ I would lead a route as a complete demonstration then have the students 'second' me. Next, I would let them lead with the security of a top-rope system. After that, I would let them attempt to lead without any external safety backups such as a top-rope. While they are leading, I would ascend on a fixed rope immediately adjacent to closely monitor their progress and provide tips and advice.

___ Formal instruction by a qualified instructor is no substitute for learning by trial and error through personal experience. I would send my students away to go and get some experience and after a few months I would accept them in a class to teach them new skills. That way, I know they are committed climbers and not out for a quick thrill. I would have them lead routes 'on-sight' without any safety backup systems such as a top rope. I would be on hand to provide advice while they lead. Excessive safety systems wrap people in cotton wool and lull them into a false sense of security – the fact is, an error while lead climbing could result in a serious accident. Lead climbers have got to get used to the idea of falling right from day one. When the students can lead on-sight without my guidance, I would regard them as competent.

Student statement:
I declare that I completed this exam paper without the assistance of others. I acknowledge that my knowledge and skill as a lead climbing could impact upon my safety including the safety of others. I accept that I may owe a duty of care to others while climbing or instructing others and that if I fail to discharge my duty, I could face legal consequences. I further accept and agree that I have a duty to maintain my knowledge and skills through regular practice, including my rescue skills.

Student signature: _____ Date: _____

Final score _____ (competency = 56/56)

COPYRIGHT