

**INSTRUCTIONS:** All the questions have to be answered. Answer parts 1, 3 and 6 on the provided answer sheets. Answer parts 2, 4 and 5 on the assessment script.

**PART 1: COMPLETE THE FOLLOWING QUESTIONS ON THE ANSWER SHEET PROVIDED FOR PART 1: MAKE A MARK UNDER TRUE OR FALSE FOR EACH STATEMENT NEXT TO THE APPROPRIATE QUESTION NUMBER. (30 MARKS)**

**Answers to questions can be found in Van Niekerk 2021: MAPWORK, LAND NAVIGATION AND BASIC MAPPING TECHNIQUES FOR GEOLOGISTS (8<sup>th</sup> revision, April 2021).**

1. A stereoscope is used for determining directions by measuring the angles between stars.
2. When the heights are portrayed at the same scale as the horizontal true ground distances can be measured along a topographic profile.
3. An azimuth is measured anticlockwise from a baseline.
4. Distances measured directly from a map, without constructing a topographic cross section only represent horizontal distances and do not take into account the rise and fall of the terrain.
5. The letters I and O can be omitted from the UTM system as they are easily confused with 1 and 0.
6. When working with scale it is not necessary to work in the matching metric units.
7. The constellation of Crux rises in the west after sunset.
8. The strike of a planar feature is the direction of 0 degrees dip angle.
9. When determining south with the southern cross and only the stars of Acrux and Gacrux are visible, you have to extend a line (the same length as the distance between Acrux and Gacrux) in the direction of Acrux 9 times.
10. The declination is used to determine the dip angle of a planar feature.
11. A map can be oriented by using terrain association.
12. Magnetic declination is the angle between magnetic north and true north.
13. A representative fraction scale of 1/100 000 indicates that one unit on a map will be 100 000 larger than the same unit on the surface of Earth.
14. The Brunton TRUEARC compass can easily be damaged if the correct procedure in setting the magnetic declination is not followed.
15. The dip direction of a planar surface is at 90 degrees to the strike of this planar surface.
16. If accuracy for distance measurement is needed, or for later drawing a geological cross section where angles need to be true, the horizontal scale and vertical scale need to be the same.
17. The magnetic declination around Johannesburg is approximately 18 degrees to the East.
18. The direction of the azimuth to the object is read off from the lower numerals on the azimuth ring as indicated by the green index marker in the magnifier.
19. When the human sun compass method is used for determining cardinal directions, north is determined by halving the angle between the imaginary hour hand and 1200 on the imaginary clock.
20. When you are looking down from high ground towards an object you are likely to underestimate the distance to this object.

21. The close proximity of a geological hammer will not influence readings taken with a compass.
22. The cardinal directions can be determined at night by studying the movements of a single star over a period of 15 minutes.
23. The direction of the azimuth to the object is read off from the upper numerals on the azimuth ring as indicated by the green index marker in the magnifier.
24. The mirror on a Brunton Truearc compass should be opened less than 70 degrees to avoid parallax-associated errors.
25. When reading off the dip direction of a set of dipping planar bedded rocks with a Brunton Truearc compass, you always read off the indicated direction on the graduated bezel from the index marker that points towards the direction into which the rocks are dipping.
26. When a tabular rock unit dips at 90 degrees, the apparent and true thicknesses of this bed will be the same.
27. You cannot determine the cardinal directions by using a single star.
28. The vertical thickness of a planar rock body dipping at 45 degrees is the same as the stratigraphic thickness of the rock body.
29. Intersection resection is used to plot the location of an outcrop on a map when you can see the outcrop in the distance, and you know your location.
30. In the UTM grid each 10 by 10 degree grid is broken down into squares of 100 000 km by 100 00 km.

**PART 2: ANSWER ALL THE FOLLOWING QUESTIONS ON THE ASSESSMENT SCRIPT (35 MARKS)**

**Answers to questions can be found in Van Niekerk 2021: MAPWORK, LAND NAVIGATION AND BASIC MAPPING TECHNIQUES FOR GEOLOGISTS (8<sup>th</sup> revision, April 2021) Chapter 8; Chapter 2; Chapter 6 and Chapter 4.**

1. Give the generic map symbol and map colour associated with the following rock types:
  - a) Granite (2)
  - b) Basaltic lava (2)
  - c) Coarse grained conglomerate (2)
2. Explain the purpose of the following parts of the Brunton Truearc compass:
  - a) The sighting line (1)
  - b) The meridian line (1)
  - c) The level (1)
  - d) The orienteering arrow (1)
  - e) The mirror (1)
3. Explain in a series of sketches, with descriptions, how strike lines are constructed from a map. (6)
4. Explain the difference between a lineation and a foliation in a rock and explain the main difference regarding measurements made to characterise these features. (6)

5. Explain how you would determine your position on a map when you are next to a river or other lengthy feature like a road. (6)
6. Explain how you can map in a flat lying area where there are no topographic features that you can use to triangulate yourself from. (6)

**PART 3: COMPLETE THE MISSING WORDS OR PHRASES ON THE PROVIDED ANSWER SHEET FOR PART 3. PLEASE WRITE DOWN THE WORDS IN THE CORRECT ORDER FOR EACH STATEMENT (30 MARKS)**

**Answers to questions can be found in Van Niekerk 2021: MAPWORK, LAND NAVIGATION AND BASIC MAPPING TECHNIQUES FOR GEOLOGISTS (8<sup>th</sup> revision, April 2021) Chapter 2.**

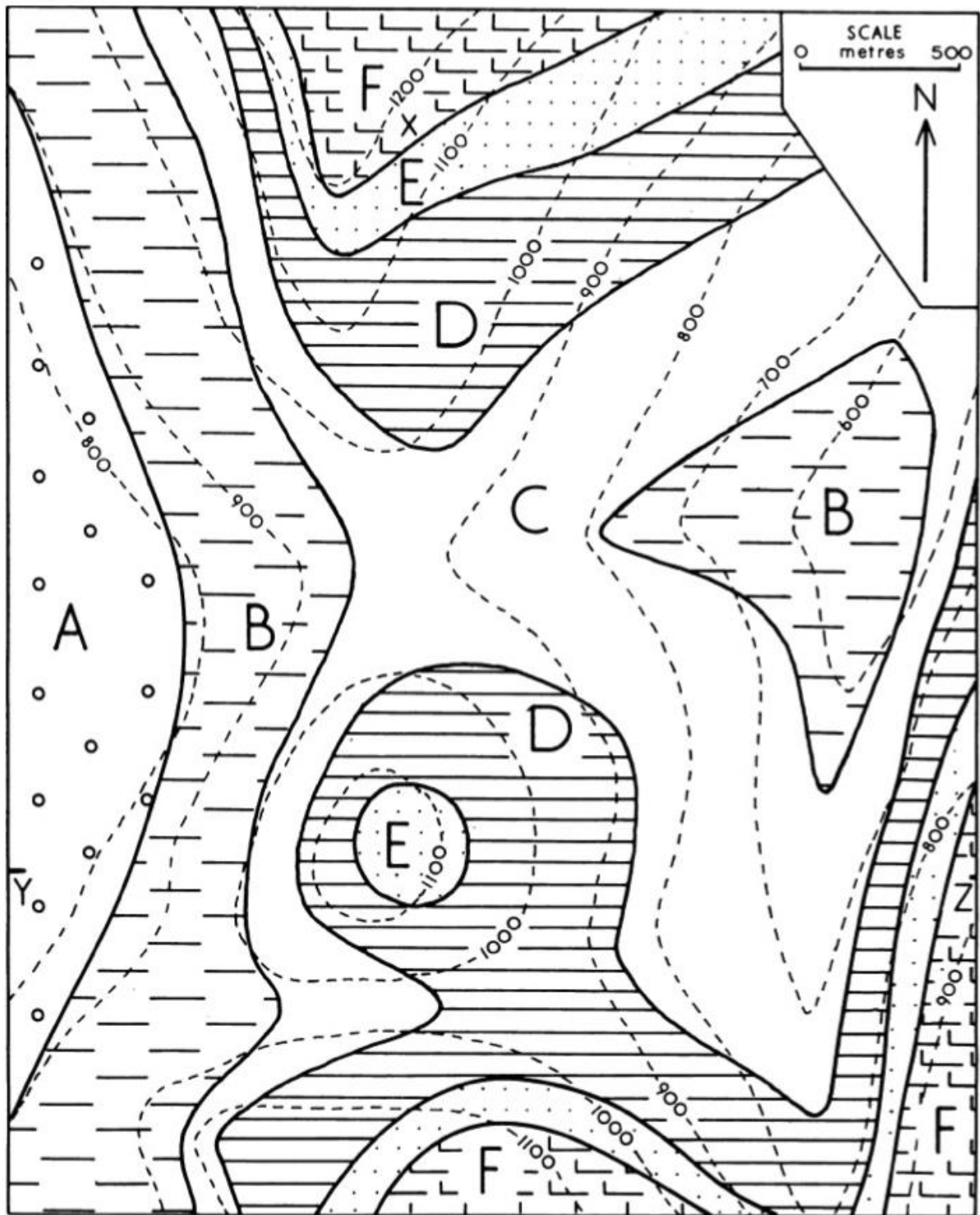
1. The declination at any given point depends on the [\_\_\_\_\_] of that point on the Earth. When the compass needle points [\_\_\_\_\_] of true north it is called “Westerly” declination” and when it points east of true north it is called “[\_\_\_\_\_]” declination. (3)
2. A compass user should be [\_\_\_] meters away from a power line, [\_\_\_] meters away from a vehicle , and [\_\_\_] meters away from a mobile phone to avoid magnetic interference with readings taken. (3)
3. To indicate a direction with the Brunton Truearc compass, hold the compass at [\_\_\_] level and adjust the cover so the top of the graduated bezel is seen in the mirror. Face [\_\_\_\_\_] your object and sight the object across the compass sight. Look in the mirror and adjust the position of the compass so that the [\_\_\_\_\_] [\_\_\_\_\_] intersects both the reflections of luminous points in the [\_\_\_\_\_] . While you simultaneously look at your object through the [\_\_\_\_\_] by keeping the sighting line across one of the luminous points, turn the [graduated] [\_\_\_\_\_] so that the orienting arrow is lined up with the needle, [\_\_\_\_\_] end between the orienting points. The bearing to your object is now the degree reading indicated at the [\_\_\_\_\_] pointer. (10)
4. Certain **basic conditions** must be met when using the Brunton Truearc compass to either indicate or determine azimuths to ensure that the compass is held straight and level.
  - a) The compass should be held at eye level and the protective mirror cover should be open to around [\_\_\_] degrees so that a top view of the compass can be seen in the mirror. (1)
  - b) When looking in the mirror the compass should be tilted until the bubble is [\_\_\_\_\_] in the level and then rotated until the sighting line on the mirror overlays the reflection of the green index marker (that is situated in the magnifier on the base plate). (1)
  - c) Make sure that the magnetic [\_\_\_\_\_] is set correctly. (1)
  - d) Set the direction you want to indicate by making sure that the green index marker overlies the direction indicated by the [\_\_\_\_\_] values on the azimuth ring by turning the rotating azimuth ring. (1)
  - e) Hold the compass in [\_\_\_\_\_] of you and make sure that the basic conditions for using the compass are in place. (1)

- f) Without changing the orientation of the compass in your hand, slowly turn in a [360] degrees arc until the red part of the global magnetic needle coincides with the red outline of the [ ] [ ] outline. (2)
  - g) Make sure that the basic conditions are still met. If not, readjust and repeat step [ ]. (1)
  - h) Once the [ ] [ ] are met and the red part of the global magnetic needle is inside the red part of the orienteering needle outline the user can look through the [ ] and this will be the direction as indicated. (3)
5. To achieve stereovision from [ ] aerial photographs a [ ] is needed. This allows the viewer to see a three-dimensional image from [ ] pairs of aerial photograph. (3)

**PART 4: EXAMINE THE ACCOMPANYING MAP AND ANSWER THE FOLLOWING QUESTIONS ON THE ASSESSMENT SCRIPT (35 MARKS)**

**Answers to questions can be found in Van Niekerk 2021: MAPWORK, LAND NAVIGATION AND BASIC MAPPING TECHNIQUES FOR GEOLOGISTS (8<sup>th</sup> revision, April 2021) Chapter 6.**

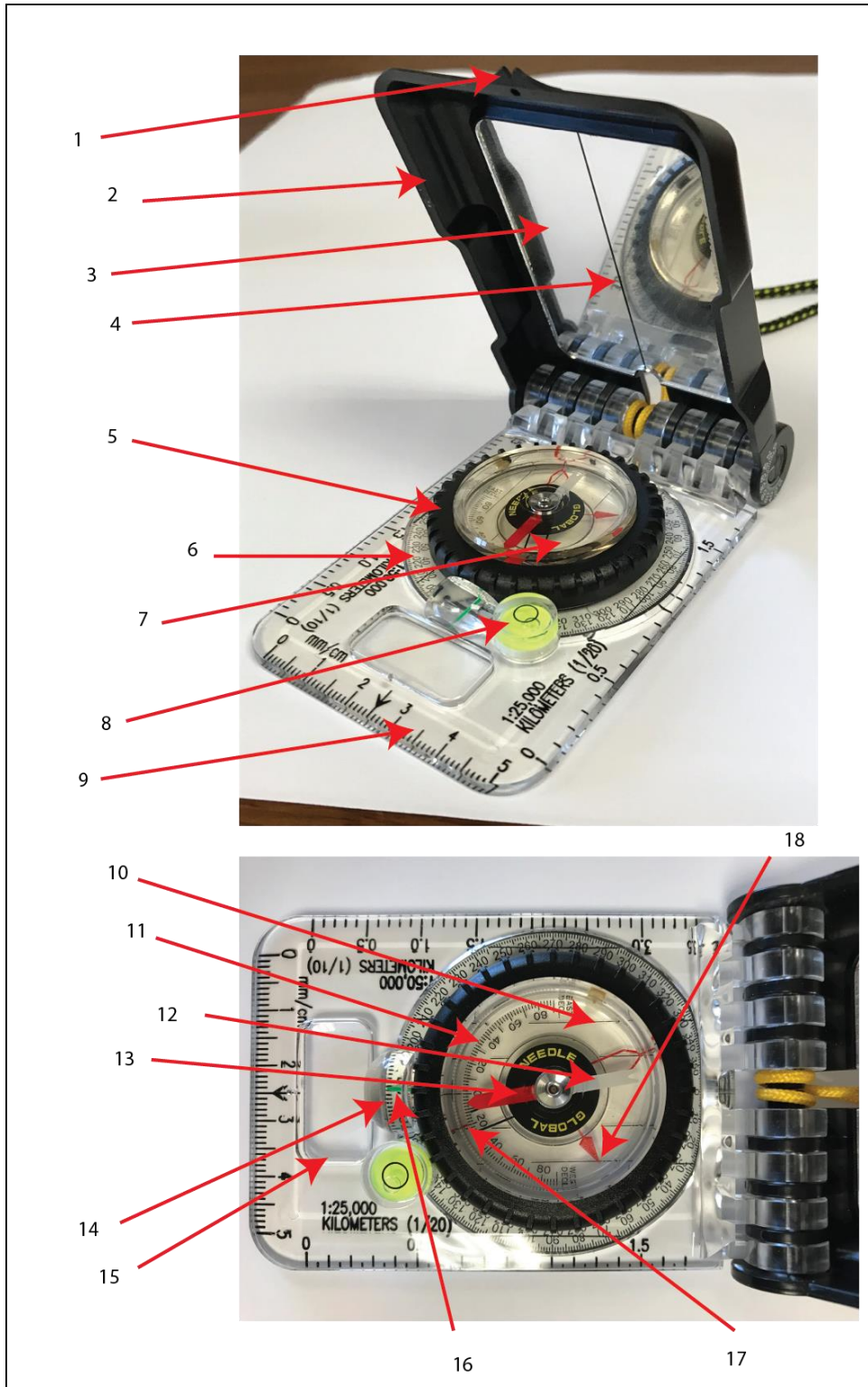
- 1. By utilising the 'rule of V', indicate the cardinal direction towards which the geological layer labelled B is dipping. (2)
- 2. Without constructing a cross section, determine the following information for bed D (show your calculations where applicable):
  - a) True dip angle (15)
  - b) Strike direction (5)
  - c) Dip direction (5)
- 3. Study the map carefully and explain why rock unit B outcrops at two different localities and levels on the map. (8)



**PART 5: COMPLETE THE FOLLOWING TASKS ON THE ASSESSMENT SCRIPT (20 marks)**

**Answers to questions can be found in Van Niekerk 2021: MAPWORK, LAND NAVIGATION AND BASIC MAPPING TECHNIQUES FOR GEOLOGISTS (8<sup>th</sup> revision, April 2021) Chapter 2.**








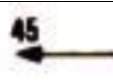


1. Label the numbered parts as indicated in the image below. (18)



2. Explain why the base of the compass must be levelled when taking bearings with the compass. (2)

**PART 6:** Complete the following tasks on the answer sheet for part 6: MATCH THE TERM/FIGURE/CONCEPT IN COLUMN A WITH THE OPTIONS IN COLUMN B. ONLY WRITE THE CORRESPONDING NUMBER OF COLUMN B NEXT TO THE NUMBER IN COLUMN A. (30 marks)

Answers to questions can be found in Van Niekerk 2021: MAPWORK, LAND NAVIGATION AND BASIC MAPPING TECHNIQUES FOR GEOLOGISTS (8<sup>th</sup> revision, April 2021).

A		B	
1		1	The degree reading from one object to another
2		2	Direction of maximum dip.
3		3	Contact position uncertain.
4		4	The angle between north and magnetic north.
5		5	Maps with scales larger than 1:1 000 000 and smaller than 1:75 000
6		6	Bedding with amount of dip.
7		7	This method is used to plot the position of an object on your map from a known point by giving a direction and a distance along that direction.
8		8	Method for mapping in distant clearly identifiable objects on your map without actually standing on them.
9		9	Bedding overturned.
10		10	Bedding vertical.
11	Strike	11	Foliation, vertical.
12	Dip direction	12	Direction of zero dip.
13	Navigational attack point	13	Bedding horizontal.
14	Handrail	14	Using pacing and pacing beads to determine where you are on a map.
15	Catching features	15	A very useful tool to determine your position on a map in absolutely featureless terrain.
16	Polar coordinates	16	A horizontal angle measured clockwise from a north base line.



A		B	
17	Intersection	17	Foliation, horizontal.
18	Global Positioning Systems	18	Constructing your own points for triangulation in featureless terrain.
19	Intersection resection	19	Linear elements like roads, highways, power transmission lines or streams that run parallel to your direction of movement.
20	Resection	20	Used to determine your position on a map by using any lengthy feature.
21	Pacing	21	Maps with scales of 1:75 000 and larger, like 1:50 000 maps.
22	Offsets	22	prominent feature along your way which will alert you that you will have to change course or direction soon.
23	Additional survey points	23	Works very well to keep track of your position in featureless terrain.
24	Magnetic declination	24	17.78 mils
25	Bearing	25	Type of catching feature that indicates to the navigator that terrain association navigation ends, and dead reckoning begins.
26	Degree	26	A technique is used for accurately determining your position on a map by using three features clearly visible on the map and the ground.
27	Azimuth	27	Maps with scales of 1:1 000 000 and smaller
28	Small scale maps	28	Lineation with amount of plunge.
29	Medium scale maps	29	Contact observed.
30	Large scale maps	30	Foliation.



Student number \_\_\_\_\_

Part 1 Answer sheet		
Question number	True	False
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**Part 3 Answer sheet.**

Student number \_\_\_\_\_

1. The declination at any given point depends on the [ ] of that point on the Earth. When the compass needle points [ ] of true north it is called "Westerly" declination" and when it points east of true north it is called "[ ]" declination. (3)
2. A compass user should be [ ] meters away from a power line, [ ] meters away from a vehicle , and [ ] meters away from a mobile phone to avoid magnetic interference with readings taken. (3)
3. To indicate a direction with the Brunton Truearc compass - Hold the compass at [ ] level and adjust cover so top of the graduated bezel is seen in mirror. Face [ ] your object and sight the object across compass sight. Look in the mirror and adjust position of compass so that the [ ] [ ] intersects both of the reflections of luminous points in the [ ]. While you simultaneously look at your object through the [ ] while keeping the sighting line across one of the luminous points, turn the [graduated] [ ] so that the orienting arrow is lined up with the needle, [ ] end between the orienting points. The bearing to your object is now the degree reading indicated at the [ ] pointer. (10)
4. Certain **basic conditions** must be met when using the Brunton Truearc compass to either indicate or determine azimuths to ensure that the compass is held straight and level.
  - i) The compass should be held at eye level and the protective mirror cover should be open to around [ ] degrees so that a top view of the compass can be seen in the mirror. (1)
  - j) When looking in the mirror the compass should then be tilted until the bubble is [ ] in the level and rotated until the sighting line on the mirror overlays the reflection of the green index marker (that is situated in the magnifier on the base plate). (1)
  - k) Make sure that the magnetic [ ] is set correctly. (1)
  - l) Set the direction you want to indicate by making sure that the green index marker is overlies the direction indicated by the [ ] values on the azimuth ring by turning the rotating azimuth ring. (1)
  - m) Hold the compass in [ ] of you and make sure that the basic conditions for using the compass are in place. (1)
  - n) Without changing the orientation of the compass in your hand, slowly turn in a [360] degrees arc until the red part of the global magnetic needle coincides with the red outline of the [ ] [ ] outline. (2)
  - o) Make sure the basic conditions are still met. If not readjust and repeat step [ ]. (1)
  - p) Once the [ ] [ ] are met and the red part of the global magnetic needle is inside the red part of the orienteering needle outline the user can look though the [ ] and this will be the direction as indicated. (3)
  - q)
5. To achieve stereovision from [ ] aerial photographs a [ ] is needed. This allows the viewer to see a three-dimensional image from [ ] pairs of aerial photograph. (3)

Student number \_\_\_\_\_

<b>Part 6 Answer sheet</b>	
Column A	Column B number
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