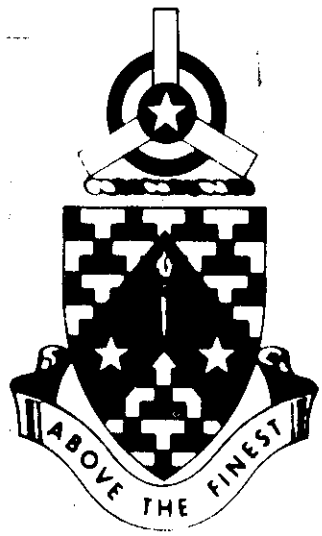
PROGRAMED TEXT

CLOUDS

AM-26



OCTOBER 1968

UNITED STATES ARMY
PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

PROGRAMED TEXT

PROGRAM TEXT

FILE NO:	**PROGRAM TITLE**
AM-26	Clouds

POI SCOPE: Cloud formation, international classification, and abbreviations. General flight conditions associated with stratiform and cumuliform clouds.

INSTRUCTOR REFERENCES:

TM 1-300, Chapter 3

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TFPL	November 1967

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Clouds

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PREFACE

The Army Aviator must be able to identify the cloud formations which are associated with day to day flying. Understanding the different cloud formations and the weather hazards associated with each type will enable you, as the aviator, to better accomplish each mission assigned.

This programed text is designed to acquaint you with the four major classifications of clouds, and to identify and interpret the flight conditions associated with clouds based below 10,000 feet.

Read and analyze the written information, then select or determine the correct answer. The correct response will be shown at the top of the next page.

PERFORMANCE OBJECTIVES

1. Given schematics of different cloud types, you will identify by appearance and/or abbreviation, those clouds that you will encounter in the performance of aviation duties.

2. Given information as to cloud types expected on a flight route, you will evaluate the flight hazards involved and specify a flight route to avoid or minimize these hazards.

FRAME 1.

Clouds may be defined as visible moisture, consisting of droplets of water or ice crystals, and are classified into four standard classifications, which are based at:

1. High (above 20,000 ft) Cirrus
2. Middle (6,500 to 20,000 ft) Alto
3. Low (50 to 6,500 ft) Stratus
4. Clouds with vertical development (usually based below 6,500 ft with tops to above 30,000 ft) and are called Cumulus or Cumulonimbus.

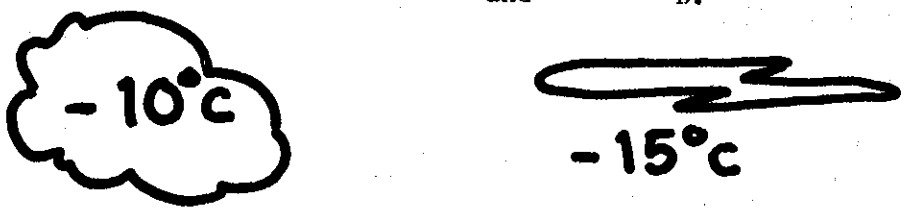
As an army aviator, we will be more interested in those clouds between the surface and 10,000 feet.

The clouds that are usually based at an altitude of 6,500 feet or lower, are called:

a. Cirrus clouds.
b. Alto clouds.
c. Cumulus and Stratus clouds.
d. All of the above.

6. Answer.

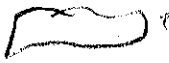
A. and B.



FRAME 7.

Altocumulus (Ac) and Altostratus (As) clouds form with bases between 6,500 and 20,000 feet. With the exception of the altitude at which found, their characteristics are the same as the Cumulus or Stratus clouds.

To see if you have retained the instruction given up to this point on stratus clouds, complete the chart below.

ALTITUDE	CLOUD TYPE	APPEARANCE	ABBREVIATION	FLIGHT CONDITION
20,000				
	Alto-Stratus		AS	smooth poor visibility
6,500				
	Nimbo-Stratus		NS	light turbulence poor visibility
	Stratus		ST	smooth poor visibility fair-poor visibility

Surface

ANSWER: c. Cumulus and Stratus clouds.

FRAME 2.

Within the four classifications of clouds are two main subdivisions developed by the way in which clouds are formed. These are:

1. As warm air rises it is cooled until the dew point is approached at which time the water vapor is condensed into water droplets or sublimated into ice crystals, depending on the temperature. The size of water droplets or ice crystals is generally dependent on the strength of the vertical currents in the clouds. In clouds with strong vertical currents, the water droplets are held in the cloud until they are relatively large before they fall as rain. These clouds are called Cumulus, or Cumuliform clouds.

2. When complete layers of air are cooled until condensation takes place, the clouds formed are called Stratus or Stratiform clouds. Fog is a form of stratus cloud found at an altitude of 50 feet or less. Fog is normally formed when the temp/dew point spread is 2°F or less, a wind less than 5 knots, and a high concentration of smoke and salt particles (Condensation Nuclei) in the air. fog is usually formed when the dew point spread is more than 40 for

NOTE: Cumuliform clouds may be merged with, or imbedded in, stratiform clouds.

Flying in the vicinity of smooth layers of clouds (Stratus) will result in a smooth flight because the vertical currents are very (light/strong).

7. Answer

ALTITUDE	CLOUD TYPE	APPEARANCE	ABBREVIATION	FLIGHT CONDITION OR HAZARD
20,000				
	Altostratus		As	Smooth flight, poor visibility, possible light rain below clouds possible icing.
6,500				
	Nimbostratus		Ns	Relatively smooth flight, generally poor visibility, continuous rain, cloud usually covers a large area, possible icing.
	Stratus		St	Smooth flight, fair to poor visibility possible icing.
	Surface			

ANSWER: Flying in the vicinity of fog or smooth layers of clouds (Stratus) will result in smooth flight because the vertical currents are very light.

FRAME 3.

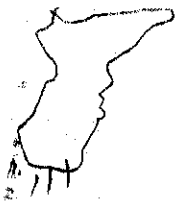
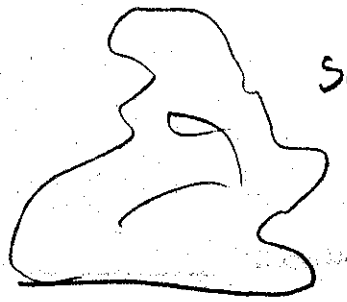
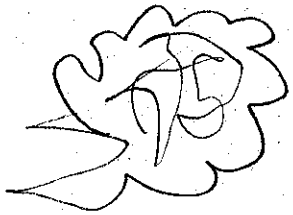
Stratus (St) clouds are characterized by their appearance as layers and cumulus (Cu) clouds appear as puffs or billows.

Complete the chart below so that it will reflect salient information about the two basic types of clouds that you will encounter as an aviator.

CLOUD TYPE	APPEARANCE	ABBREVIATION	FLIGHT CONDITION
cumulus	 (Sketch)	cu	Visibility - Good except in rain Turbulance - Vertical currents producing rough flight Precipitation - big rain drops
STRATUS	 (Sketch)	st	Visibility - poor haze Turbulance - light Precipitation - small rain drops

FRAME 8

To review the cumulus clouds, complete the chart below.

ALTITUDE	CLOUD TYPE	APPEARANCE	ABBREVIATION	FLIGHT CONDITION
20,000	Alto-cumulus		ac	good vsb, poss. mod light turb.
6,500	Cumulonimbus		cb	good vsb, except when inside poss. occ. ~~fair turb~~ bad turb
	Stratocumulus		sc	poss. occ. light turb, fair vsb.
	Cumulus		cu	good vsb.

Surface

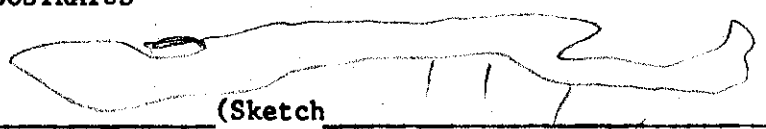
3. Answer.

CLOUD TYPE	APPEARANCE	ABBREVIATION	FLIGHT CONDITION
CUMULUS	 (Sketch)	Cu	Visibility - Good except in rain. Turbulance - Vertical currents producing rough flight Precipitation - big rain drops
STRATUS	 (Sketch)	St	Visibility - poor, hazy Turbulance - smooth or light Precipitation - small rain drops

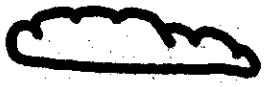
FRAME 4.

When heavy precipitation is produced (either liquid or solid) from a cloud the word "NIMBUS" is added to the name of the basic cloud type Stratus clouds with falling precipitation are called NIMBOSTRATUS (Ns) and heavy, swelling Cumulus clouds that have grown into a thunderstorm, called CUMULONIMBUS (Cb). Cumulonimbus clouds are more dangerous than any other type cloud because of the severe vertical currents that may damage the aircraft structure. Many cumulonimbus clouds contain heavy rain, hail, and/or ice. You should go around (Circumnavigate) this cloud, or land and wait for better weather.

Complete the chart below:

CLOUD TYPE	APPEARANCE	ABBREVIATION	FLIGHT CONDITION
cumulonimbus	 Cb.		Visibility - Good except in rain. Turbulance - Vertical air currents - severe Precipitation - heavy rain, hail or icing when the temperature is near or below freezing.
NIMBOSTRATUS	 (Sketch	NS	Visibility - low hazy Turbulance - light Precipitation - light

8. Answer

ALTITUDE	CLOUD TYPE	APPEARANCE	ABBREVIATION	FLIGHT CONDITIONS
20,000				
	Altocumulus		Ac	Good visibility, light turbulance possible icing in clouds
6,500				
	Cumulonimbus		Cb	Good visibility except in rain near cloud, severe turbulance, possible hail or heavy rain, ice in Temp. zone of 0°C to -20°C
	Stratocumulus		Sc	Light to moderate turbulance, fair to poor visibility, possible icing in clouds.
	Cumulus		Cu	Generally good weather, good visibility, moderate turbulance, may have heavy rain or icing in vicinity of cloud
	Surface			

FRAME 9.

Although you will have no occasion to fly a helicopter into high clouds (20,000 and above) such as Cirrus (Ci), Cirrocumulua (Cc), or Cirrostratus (Cs), they can be useful in assisting you to determine when you are approaching different weather conditions.

The type clouds that will give you indication of changing weather conditions is:

a. Stratiform
b. Cumuliform
c. Cumulonimbus
d. Cirroform

4. Answer.

CLOUD TYPE	APPEARANCE	ABBREVIATION	FLIGHT CONDITION
CUMULONIMBUS (Note Anvil top)			Visibility - Good except in rain. Turbulance - Vertical Precipitation - heavy rain, hail or icing when the temperature is near or below freezing.
NIMBOSTRATUS		Ns	Visibility - Poor Turbulance - light to moderate Precipitation - Small rain drops or build up of ice in near freezing temperature.

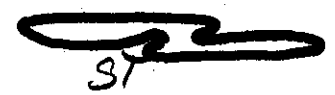
FRAME 5.

It is possible to find cloud types in combination. As a matter-of-fact Stratocumulus (Sc, sometimes called strato-cu) clouds are smooth on the bottom the same as stratus and like cumulus they billow on the top.

Identify the Stratocumulus cloud:

A.

C.

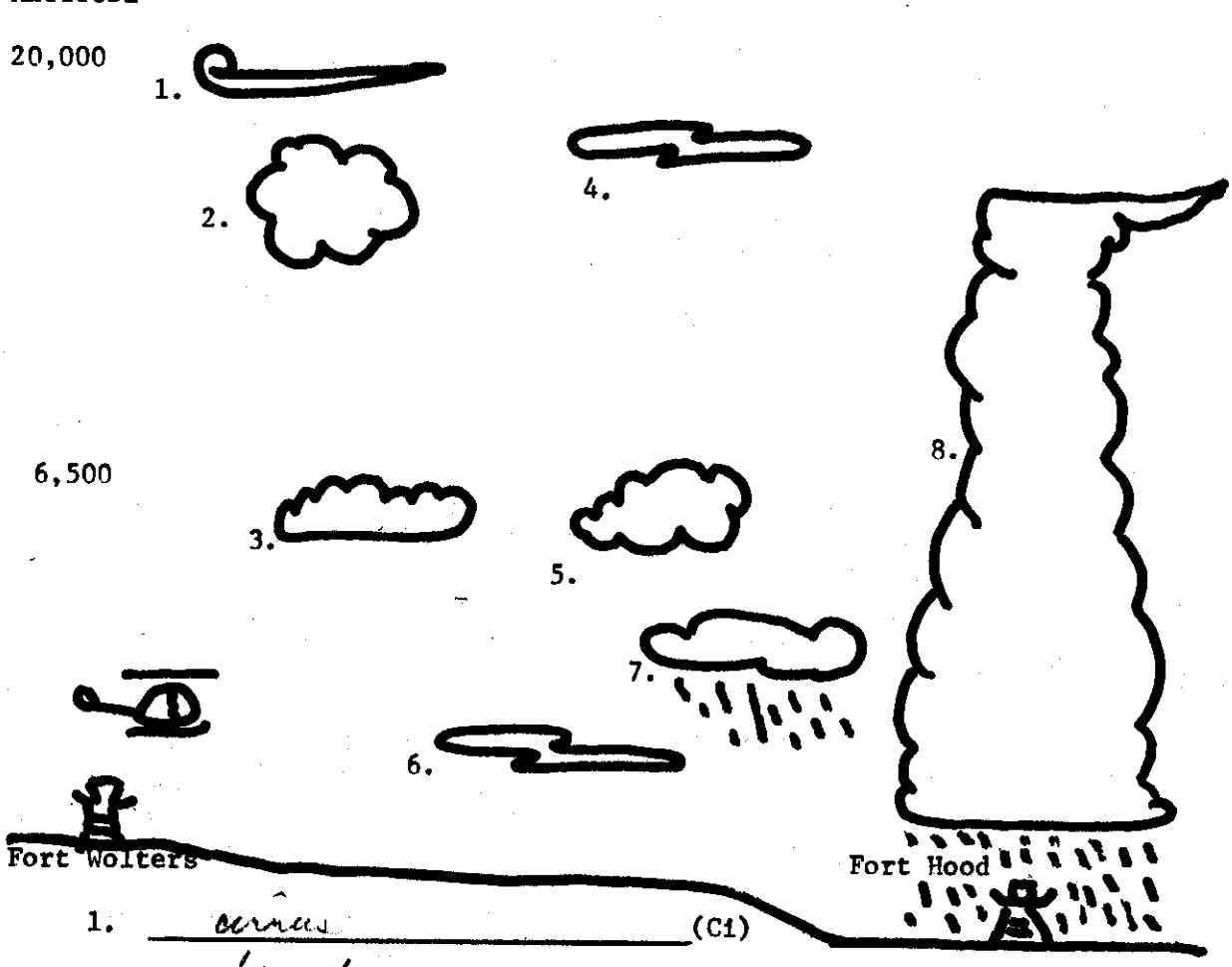


Note: Clouds not accurate as to relative size

9. Answer - d. Cirroform

FRAME 10.

Identify the clouds depicted below in the order in which they would be observed if you were flying from Fort Wolters to Fort Hood.



1. cirrus (Ci)
2. altoculus (Ac)
3. strato-cumulus ( )
4. alto-stratus ( )
5. cumulus (Cu)
6. strato ( )
7. nimbostratus ( )
8. cumulonimbus ( )

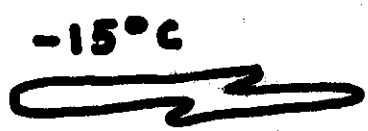
5. Answer.

B.

FRAME 6.

Cumuliform and Stratiform clouds may contain super cooled water droplets that can produce icing when the temperature is below freezing (0°C to -20°C). Note: More detailed information on icing is presented later in the course.

In which of the following cloud formations would you expect to encounter icing conditions.

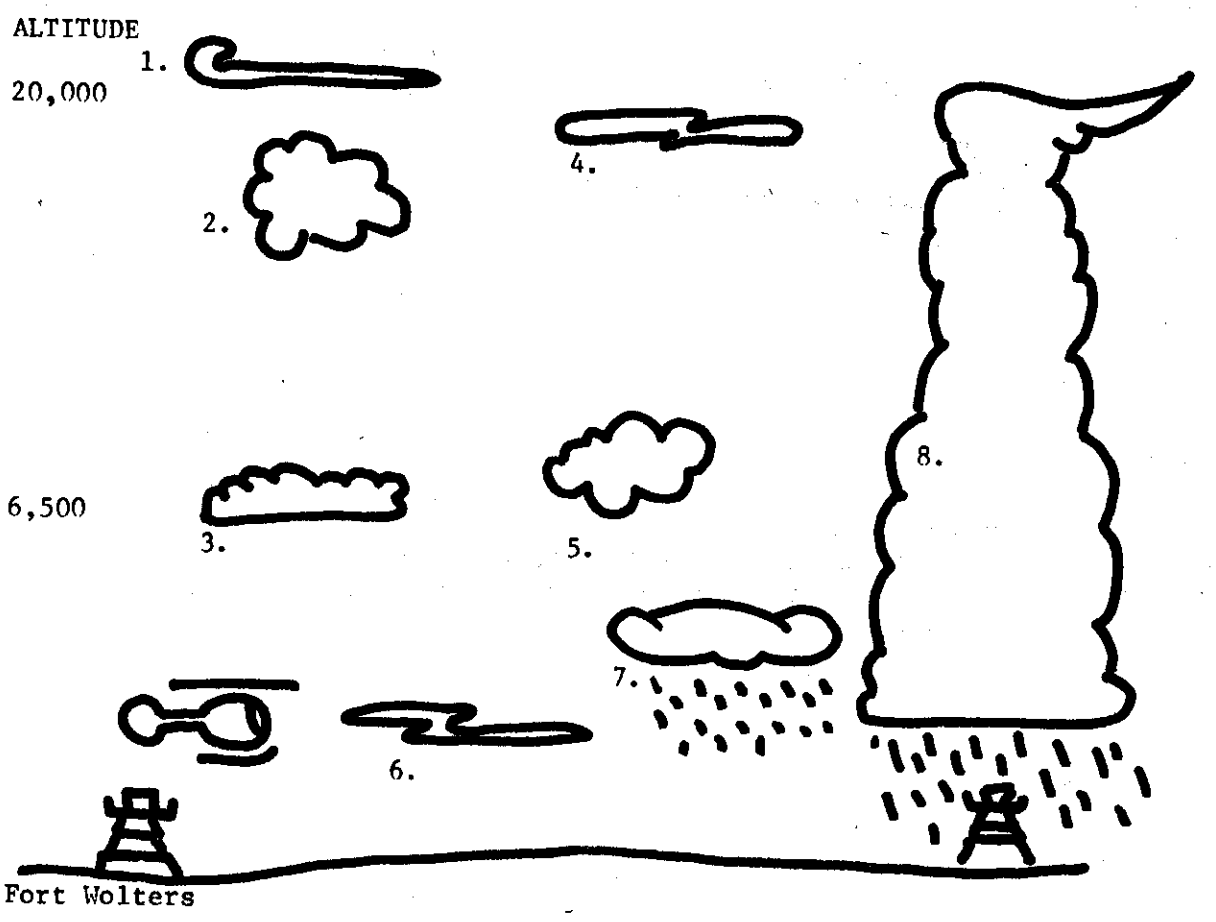


B.

C.

TURN TO PAGE 2 FOR FRAME 7.

10. Answer.



In the sketch above, if you were flying from Fort Wolters to Fort Hood, you would encounter the clouds in the following order:

1. Cirrus (Ci)
2. Altocumulus (Ac)
3. Stratocumulus (Sc)
4. Alto Stratus (As)
5. Cumulus (Cu)
6. Stratus (St)
7. Nimbostratus (Ns)
8. Cumulonimbus (Cb)

SELF EVALUATION EXERCISE
ON
CLOUDS

1. The four major groups of clouds are further subdivded into _____ types of clouds.

   a. Ice producing and non-ice producing.
   b. Cumuliform and stratiform.
   c. Moist and dry.
   d. High, middle, low and accentuated vertical development.

2. When heavy precipitation is produced (either liquid or solid) from a cloud, the word _____, is added to the basic cloud type.

   a. Alto
   b. Precipitant
   c. Nimbus
   d. Cirro

3. A cumulus cloud and an alto cumulus cloud are very similar, except for:

   a. Size and temperature
   b. Temperature and shape
   c. Altitude
   d. Size and shape

4. The type, or types, of clouds that you will encounter which have extensive vertical development and moderate to severe turbulance are _____.

   a. Cirrus
   b. Stratus
   c. Cumulus
   d. All of the above

5. The weather forecaster's briefing indicated that you will encounter a band of cumulus build-ups enroute to your destination. You should expect _____.

   a. smooth flight and good visibility except in rain.
   b. turbulent flight and poor visibility except in rain.
   c. smooth flight and poor visibility except in rain.
   d. turbulent flight and good visibility except in rain.

6. The weather forecaster briefs you that scattered Cb will be forming along your flight route in the early afternoon. You should know that:

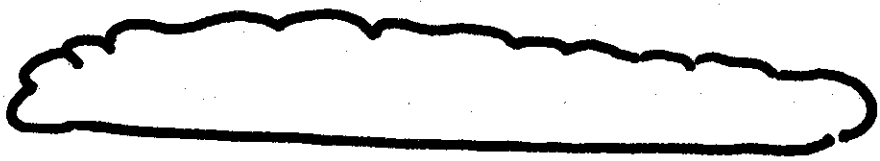
a. Smooth flight conditions, poor visibility and light rain will probably be encountered if you attempt the flight.

b. Rough flight conditions, good visibility and heavy rain will probably be encountered if you attempt the flight.

c. You cannot make the flight in a helicopter.

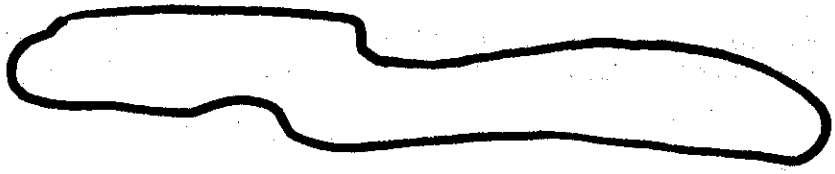
d. You can make the flight in a helicopter if you have an instrument certificate.

7.



2500

2000 -3°C



1500

Surface

On a local flight with the above cloud types and temperature, you would expect to find:

a. Smooth flight conditions at 1,000 feet, with possible icing if you climb up to 1,500 feet.

b. Rough flight conditions at 1,000 feet, with possible icing if you climb up to 1,500 feet.

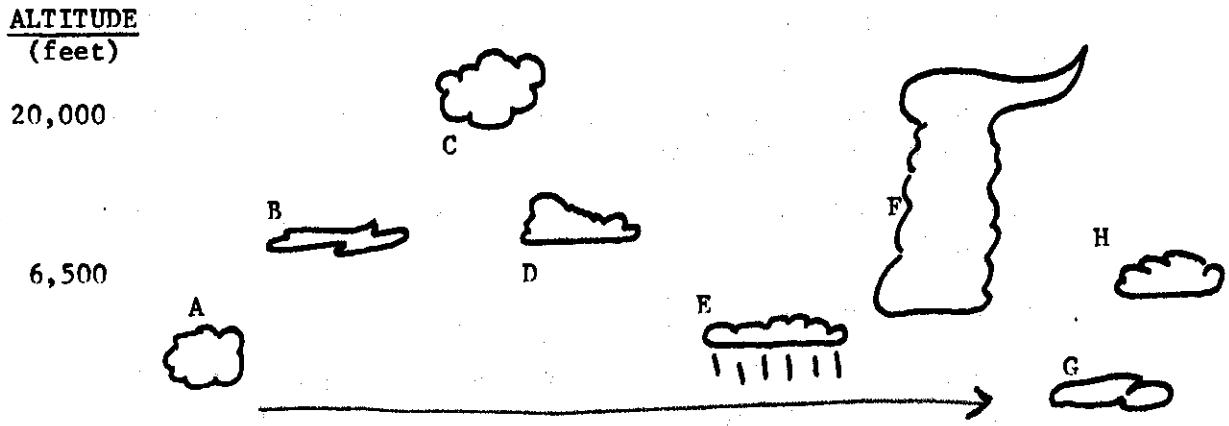
c. Rough flight conditions at 2,000 feet, but no icing.

d. Smooth flight conditions at 2,000 feet, with icing conditions as you maintain 2000 feet altitude on your flight.

8. You are on a night cross-country flight. You decide to tune the radio and monitor the local weather report. In the report for your destination the temperature is reported to be 42°F and dew point 40°F with wind 3 to 5 knots. You should expect_____ _____at your destination.

a. Hail
b. Heavy rain
(c) Low clouds or fog
d. Nice weather

Refer to the sketch below to answer questions 9 thru 15 below:



9. If you were flying the helicopter depicted above, you would observe these clouds in the following order: A to G

a. Cu, As, Ac, Ns, Sc, Cb
b. Cu, As, Ac, Sc, Ns, Cb
c. Cu, As, Ac, Sc, Ns, Cn
d. Cu, As, Ac, Ns, Scm Cn

10. Flight in the vicinity of cloud E would be characterized by:

a. Poor visibility, low temperature and fog
b. Heavy rain, hail, ice and severe turbulance
c. Low visibility and rain, with probable ice
d. Low visibility and rain, with smooth flight conditions

11. The visibility in the vicinity of the Altocumulus cloud would be:

a. Good
b. Poor

12. Flight in the vicinity of cloud A would be

a. smooth
b. turbulent

13. In planning this flight, you would anticipate the most unfavorable flight conditions in the vicinity of cloud:

a. E
b. F
c. G
d. H

14. The flight technique used on this flight in the vicinity of cloud F is to:

a. Slow your helicopter down to 40 knots and continue through the cloud using your instruments.

b. Enter the cloud near the base, as that is the area of Least Turbulance.

c. Circumnavigate the cloud.

d. Continue on course, flying beneath the cloud, and through the area of least rainfall.

15. Flight in the vicinity of cloud G would be characterized by:

a. Poor visibility, and severe turbulance.

b. Good visibility, with turbulance and rain.

c. Good visibility, with smooth flight conditions.

d. Poor visibility, smooth flight conditions.

16. High (cirroform) clouds are important to the army aviator because:

a. They can give an indication of changing weather conditions.

b. They normally contain icing conditions that will have an adverse effect on your mission.

c. They are associated with severe thunderstorms.

d. They specify the exact type of weather you should expect if you continue on course.

INTENTIONALLY

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ANSWERS TO SELF EVALUATION EXERCISE

1. b
2. c
3. c
4. c
5. d
6. b
7. a
8. c
9. b
10. d
11. a
12. b
13. b
14. c
15. d
16. a