

Exploring the World of Science

# Meteorology 

## HOLT INVITATIONAL 2017

SCHOOL: $\qquad$ TEAM \# $\qquad$

TEAM MEMBERS: $\qquad$ \& $\qquad$

SCORE: $\qquad$ TIME COMPLETED: $\qquad$

PLACE: $\qquad$

## DIRECTIONS:

All answers must be written on the Meteorology Answer Sheet. All other answers will not be graded.

There are two pre-identified tiebreakers on the test. If a tie is not broken with the tie breakers, then team that completed the test in the shortest amount of time will place above the other team.
1.
2. $\qquad$
3. $\qquad$
4. $\qquad$
5. $\qquad$
6. $\qquad$
7. $\qquad$
8. $\qquad$
9. $\qquad$
10. $\qquad$
11. *
12. $\qquad$
13.
$\qquad$
14. $\qquad$
15. $\qquad$
16. $\qquad$
17. $\qquad$
18. $\qquad$
19. $\qquad$
20. $\qquad$
21. $\qquad$
22. $\qquad$
23. $\qquad$
24. $\qquad$
25. $\qquad$
26. $\qquad$
27. $\qquad$
28. $\qquad$
29. $\qquad$
30. $\qquad$
31. $\qquad$
32. $\qquad$
33. $\qquad$
34. $\qquad$
35. $\qquad$
36. $\qquad$

* Tiebreaker Question

Label the type of fronts shown below:

Given the following weather map of the beginning stage of a mid-latitudinal cyclone, please fill in the missing labels:
A. $\qquad$
B. $\qquad$
C. $\qquad$
D. $\qquad$
E. $\qquad$

Given the following weather map of a mid-latitudinal cyclone, please fill in the missing labels: Where in the life cycle is this cyclone (circle one): Early
A. $\qquad$
B. $\qquad$
C. $\qquad$
D. $\qquad$

Look at the Storm Events Database -February 23-24 Tornado Outbreak. What classification would be given to this tornado according to the Fujita scale?

On the Best Track for Hurricane Patricia, 20-24 October 2015 and using the Saffir-Simpson Scale, label the category of hurricane in the stage column from October 22 at 0600 (labeled hurricane) to October 24 at 0000. (Helpful hint: 1 knot $=1.15 \mathrm{mph}$ ) Tiebreaker \#2

Why does the intensity of a hurricane diminish rapidly when it moves onto land?

## Storm Events Database -February 23-24 Tornado Outbreak

## Event Details:

| Event | Tornado |
| :---: | :---: |
| -- Scale |  |
| -- Length | 4.33 Miles |
| -- Width | 625 Yards |
| State | LOUISIANA |
| County/Area | LIVINGSTON |
| WFO | LIX |
| Report Source | NWS Storm Survey |
| NCEI Data Source | CSV |
| Begin Date | 2016-02-23 12:42:00.0 CST-6 |
| Begin Location | 1WSW LIVINGSTON |
| Begin Lat/Lon | 30.496/-90.7592 |
| End Date | 2016-02-23 12:51:00.0 CST-6 |
| End Location | 3N DOYLE |
| End Lat/Lon | 30.5462/-90.7156 |
| Deaths Direct/Indirect | 0/0 (fatality details below, when available...) |
| Injuries Direct/Indirect | 0/0 |
| Property Damage |  |
| Crop Damage | 0.00K |
| Episode <br> Narrative | A strong cold front moved through the lower Mississippi Valley. Ahead of the front, widespread severe weather moved through Southeast Louisiana and Southern Mississippi during the morning and afternoon hours of February 23rd. A total of 13 tornadoes occurred in Southeast Louisiana and Southern Mississippi, 3 of which were classified as strong. |
| Event Narrative | The tornado touched down in a wooded area between Grantham and McLin Roads southwest of Livingston. In this area, it snapped trees and caused roof damage. As it moved northeastward, it strengthened and widened. The tornado completely removed the roof structure of one home on Circle Drive and another on West Railroad Street. The tornado is believed to have been its strongest as it approached North Willow Street. Here, it removed the entire roof structure of a home and collapsed an exterior wall of a home. Maximum wind speeds in this area were estimated to be 125 mph . The tornado then weakened as it moved into a mostly wooded area, but continued to cause damage to trees and a few roofs, lifting as it approached the intersection of North Doyle Road and Edgar Mizell Road. |

Write the answers to the multiple choice questions 1-36 on the Meteorology Answer Sheet. Answers circled and not on the answer sheet will not be graded.

1. Which statement best describes a front?
a. A large body of air with similar temperature and humidity
b. The boundary between a warm air mass and a cold air mass
c. The first stage of a thunderstorm
d. An area of low pressure characterized by rotating and converging winds
2. Along a front, which air always is forced aloft?
a. The fastest moving air
b. The driest air
c. Warmer, less dense air
d. Cooler, denser air

## Match the following characteristics with the correct air mass:

3. warm, dry air
a. maritime polar
4. warm, humid air
b. continental polar
5. cool, dry air
c. maritime tropical
6. cooler, moist air
d. continental tropical
7. Surface airflow in a Northern Hemisphere middle latitude cyclone moves:
a. Clockwise
b. Counterclockwise
8. Winds are caused by:
a. Air masses
b. Warm, dry air
c. Humidity differences
d. Differences in air pressure
9. Which of the following is an example of mesoscale?
a. Trade Winds
b. Turbulence
c. Thunderstorms
d. Hurricanes
10. In a mid-latitudinal cyclone where would you expect to find a line of thunderstorms?
a. Cold front
b. Warm front
c. Occluded front
d. Stationary front
11. Which of the following is the most dangerous hazard of a thunderstorm? Tiebreaker \#1
a. Lightning
b. Flash floods
c. Hail
d. Wind
12. The stage in a thunderstorm where strong updrafts and downdrafts coexist.
a. Mature Cumulus Stage
b. Dissipating Stage
c. Towering Cumulus Stage
d. Supercell Stage
13. Which of the following is not an ingredient for a thunderstorm?
a. Moisture
b. Lifting mechanism
c. Instability
d. Squall line
14. Which one of these clouds can produce heavy precipitation?
a. cumulonimbus
b. stratocumulus
c. altostratus
d. nimbostratus
15. Which of the following is not required for precipitation?
a. condensation nuclei
b. a source of lift
c. moisture
d. southerly winds
16. What stage of development of a thunderstorm is indicated by the cloud in the following photograph?

a. Mature Cumulus Stage
b. Dissipating Stage
c. Towering Cumulus Stage
d. Supercell Stage
17.What is the cloud shown in number 16 called?
a. Nimbostratus
b. Cumulonimbus
c. Nimbocumulus
d. Altostratus
17. The most likely stage for large hail and damaging winds is the...
a. Mature Cumulus Stage
b. Dissipating Stage
c. Towering Cumulus Stage
d. Supercell Stage
18. The type of thunderstorm that produces nearly all of the significant tornados is the...
a. Cluster storm
b. Squall line
c. Single cell
d. Supercell
19. Which state is not in tornado Alley?
a. Kansas
b. North Dakota
c. Nebraska
d. Texas
20. How long should you stay in shelter after the last thunder is heard?
a. 10 minutes
b. 20 minutes
c. 30 minutes
d. 60 minutes
21. Most tornados are spawned by a special kind of thunderstorm called a:
a. supercore
b. supercell
c. multicell
d. multicore
22. About how many tornados strike the U.S. each year?
a. 100
b. 500
c. 1,000
d. 5,000
23. The National Weather Service defines a blizzard as a storm which contains large amounts of snow or blowing snow, with winds in excess of $\qquad$ and visibilities of less than
$\qquad$ mile for a period of at least 3 hours.
e. $10 \mathrm{mph}, 1$ mile
f. $35 \mathrm{mph}, 1 / 4$ mile
g. $50 \mathrm{mph}, 1 / 2$ mile
h. $65 \mathrm{mph}, 1 / 2$ mile
24. Blizzards conditions often develop on the $\qquad$ side of an intense storm system.
a. Northwest
b. Southeast
c. East
d. West
25. When the wind chill reaches $-35^{\circ} \mathrm{F}$, how quickly does frostbite occur?
a. 10 minutes
b. 15 minutes
c. 20 minutes
d. 30 minutes
26. If thunder is heard 15 seconds after lightning is seen, about how far away was the lightning stroke?
a. About 1600 m
b. About 3200 m
c. About 5000 m
d. About 6400 m
27. A line of thunderstorms may form as much as 300 km ahead of a cold front along a narrow belt. This is called a:
a. Squall line
b. Supercell
c. Multi-cell
d. Supercore
28. Nor'easters that strike New England often occur with a pressure area northeast of the storm, over the Atlantic Canada. Why is the anticyclone important?
a. The strong pressure gradient between the high and low pressure systems result in strong winds.
b. Cold flow from the high increases the storm's thermal contrast, making a stronger cyclone.
c. Oceanic air provides the moisture that becomes heavy rain and/or snow.
d. All of the above
e. None of these factors apply
29. Which of the following cities does not typically receive lake effect snow?
a. Traverse City, Michigan
b. Toronto, Ontario
c. Minneapolis, Minnesota
d. Buffalo, New York
e. All of these cities are affected by lake effect snow
30. On December 8, 2016 a brief, intense snow showers accompanied by strong, gusty winds and snow accumulation caused a 40 car pile-up on l-96 near Fowlerville. This was known as a:
a. Blizzard
b. Snow Squall
c. Lake effect snow
d. Supercell
31. A tropical cyclone in the Atlantic and eastern Pacific is referred to a:
a. Hurricane
b. Typhoon
c. Cyclone
d. Anti-cyclone
32. A tropical cyclone in the western Pacific and Philippines is referred to as a:
a. Hurricane
b. Typhoon
c. Cyclone
d. Anti-cyclone
33. Tropical cyclones typically begin as a complex of thunderstorms but then evolve through a series of stages. The first stage after a complex of thunderstorms form is the formation of a weak:
a. Tropical Storm
b. Tropical Depression
c. Hurricane
d. Tropical trough
34. Which of the following hurricanes were classified as a category 5 ?
a. Camille
b. Katrina
c. Andrew
d. Liz
e. Both a and b
35. During what time of year do most of the hurricanes affect the United States?
a. Early summer
b. Late summer
c. Spring
d. Late Fall
