ATSC 201   **Midterm Exam**   Name: _____
Prof. Stull   (open books, notes, calculator)
Fall 2016   (45 points ≈ 1 minute/point)   Student Number: _____

Use the attached "bubble sheet" to indicate your answers IN PENCIL. You can separate the bubble sheet from the rest of the exam questions.   Be sure to put your name and student number on both this question sheet and the bubble answer sheet.   If you make a mistake and change your answer on the bubble sheet, please thoroughly and cleanly erase the old wrong answer.

•••••••

(3 points) Plot the following temperature sounding on the attached thermo diagram. You will hand in this plot, so be sure to put your name and student number on the top of the thermo diagram.
[P (kPa), T (°C)]:   [100,10]   [75, 10]   [60,–20]   [40, –25]   [30, –44]   [25, –51]   [20, –51]
Then use your plot to answer the following 3 questions.

1) (1 points) At what pressure (kPa) is the tropopause?   A) 60   B) 40   C) 30   D) 25   E) 20

2) (2 points) There is one statically unstable layer.   Which of the following pressures (kPa) is closest to the BOTTOM of the unstable layer?   A) 100   B) 85   C) 75   D) 60   E) 50

3) (2 points) For that same unstable layer, which of the following pressures (kPa) is closest to the TOP of the unstable layer?   A) 75   B) 60   C) 50   D) 40   E) 30

•••••••

(2 points) Forget the previous sounding, but use the same thermo diagram to plot the following. Consider just the following one air parcel that starts at   [P(kPa), T(°C), Td(°C)]   =   [100 , 40 , 20]. This parcel is then lifted to a final pressure of P = 50 kPa. Use this info for the next 4 questions.

4) (1 pt) Which value is closest to its starting relative humidity? A) 15%   B) 20%   C) 30%   D)40%   E) 50%

5) (1 points) For the air parcel from the previous question, what pressure (kPa) is closest to its LCL?
      A) 80   B) 75   C) 65   D) 50   E) (the LCL is not reached by this air parcel)

6) (2 points) Which answer is closest to the final temperature (°C) of this same air parcel?
      A) 20   B) 15   C) 10   D) 5   E) 0

7) (1 points) Which answer is closest to the final liquid-water mixing ratio r_L (g/kg) for this air parcel?
      A) 0   B) 7   C) 8   D) 9   E) 15

•••••••

(5 points) Plot the following wind sounding on the attached hodograph. You will hand in this hodograph, so put your name and student number on the top of it. Use this hodograph to answer the next questions

z (km)	wind direction (°)	wind speed (m/s)
0	180	10
1	210	15
2	240	18
3	270	20
4	300	23
5	330	30
6	360	40

8) (2 points)   If a thunderstorm forms in the environment that you plotted on the hodograph, the NORMAL motion of the whole storm (before it possibly splits into right- or left-moving storms) is closest to which of the following answers? Hint, use the graphical method.   [storm direction (°), speed (m/s)] is:
      A) [203, 11]   B) [271, 11]   C) [272, 21]   D) [302, 11]   E) [360, 21]

9) (1 points) If this storm splits into multiple thunderstorms, which is most likely to become the most intense?
   A) right-moving   B) normal   C) left-moving

10) (2 points) The wind a 4 km altitude has what [U, V] components?   Units are (m/s).
    A) [300, 23]   B) [20, 12]   C) [12, 20]   D) [–12, 23]   E) [20, –12]
••••••••

For the Radar image at right (courtesy of NSSL)...

11) (1 points) The name of the dominant weather feature in this image
is: A) squall line   B) supercell   C) hook echo
           D) tornado   E) gust front

12) (2 points) How much stronger is the radar echo in a region shaded
as 60 dBZ on the radar image relative to other parts that are shaded as
10 dBZ?   A) 6   B) 50   C) 1000   D) 10,000   E) 100,000

13) (2 points) If the radar echo is 40 dBZ, then use Z-R relationships
to find the approximate rainfall rate (mm/h).
       A) 1.2   B) 12   C) 120 D) 1,200 E) 12,000
••••••••

Suppose a weather map has straight isobars running exactly east-
west. The higher pressure isobars are to the north, and the lower-
pressure isobars are to the south. The north-south pressure gradient is
5 kPa/1000km. Assume altitude is sea level, in the N. Hemisphere.

14) (3 points) The geostrophic wind speed (m/s) is roughly:
        A) 10 B) 20 C) 30   D) 40   E) 300

15) (1 points) The geostrophic wind direction is: A) north   B) east
C) south   D) west   E) up

16) (1 points) The boundary layer wind direction is: A) northeast B) southeast C) southwest D) northwest
••••••••

17) (2 points) Given a dry atmospheric layer with top and bottom at P = 50 and 80 kPa, respectively.
    If the average temperature in that layer is 15°C, then what is the approximate thickness (m) of that layer?
        A) 200 B) 400   C) 800 D) 1600 E) 4000

18) (1 points) You live in the ____sphere: A) tropo B) strato   C) meso D) thermo   E) exo
••••••••

19) (1 points) Advection must be considered in ____ budgets. A) Lagrangian B) Eulerian C) Newtonian

20) (1 points) A mesocyclone has initial thickness 8 km at latitude 50°. Then it moves east and stretches to
    10 km thickness. Its relative vorticity will: A) decrease B) be conserved (i.e., not change)   C) increase

21) (2 points) A tornado completely destroys a house, leaving a pile of debris.   Its strength is EF__:
    A) 1   B) 2   C) 3   D) 4   E) 5.

22) (3 points) If the earth were shaped like a flat disk, then Coriolis force would be: A) greatest at the center
    B) greatest at the outside edge   C) zero everywhere   D) a finite constant everywhere E) infinite
    everywhere
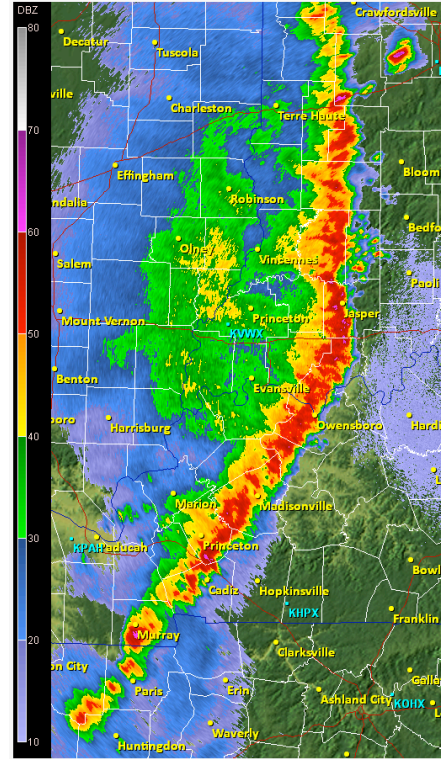
--end--   Attachments: thermo diagram, hodograph,   bubble page   (you will hand in all pages)
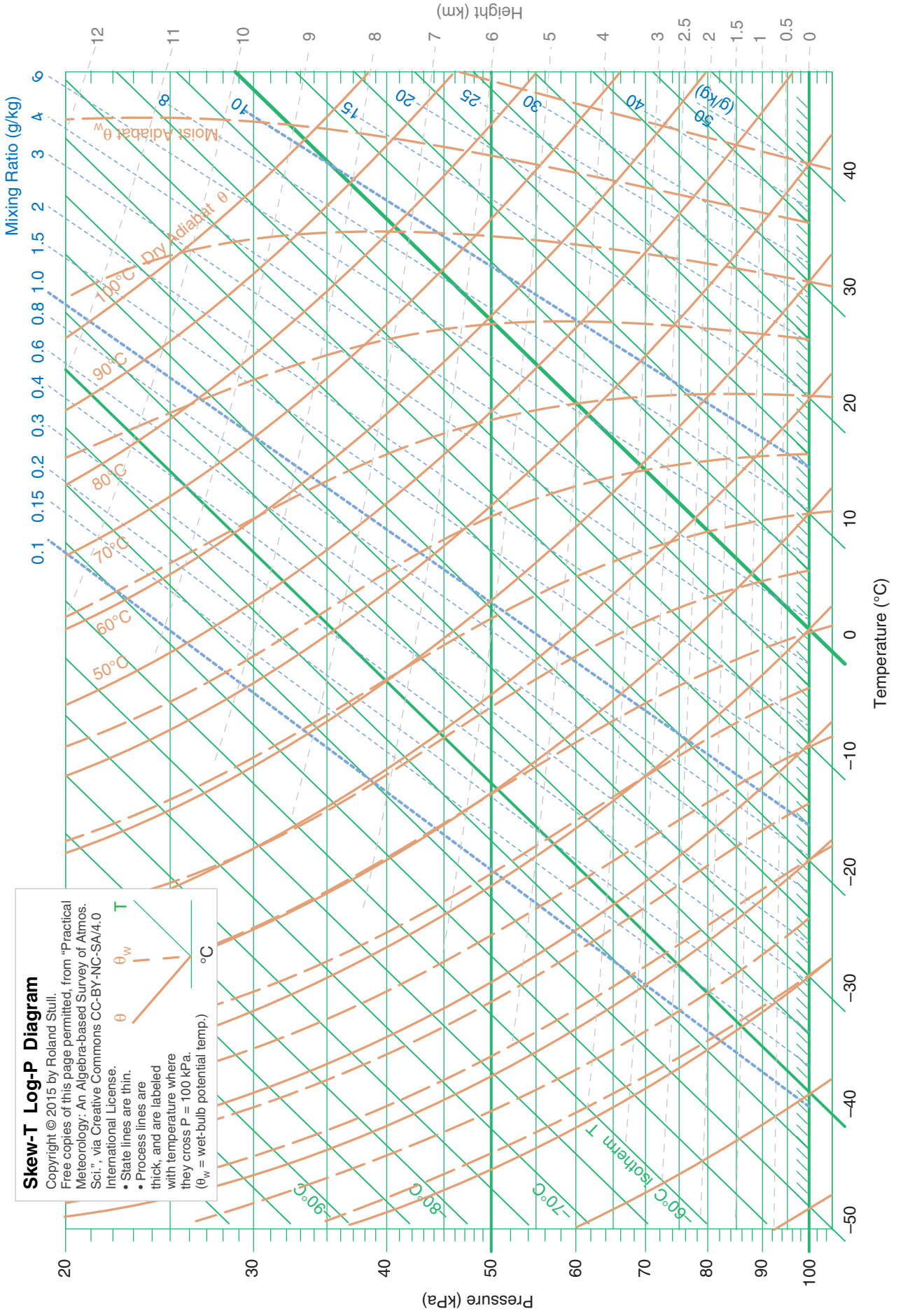
Skew-T Log-P Diagram

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Free copies of this page permitted, from "Practical
Meteorology: An Algebra-based Survey of Atmos.
Sci.", via Creative Commons CC-BY-NC-SA/4.0
International License.
• State lines are thin.
• Process lines are
thick, and are labeled
with temperature where
they cross P = 100 kPa.
(θ_w = wet-bulb potential temp.)

T
θ_w
θ
°C

Figure 14.51
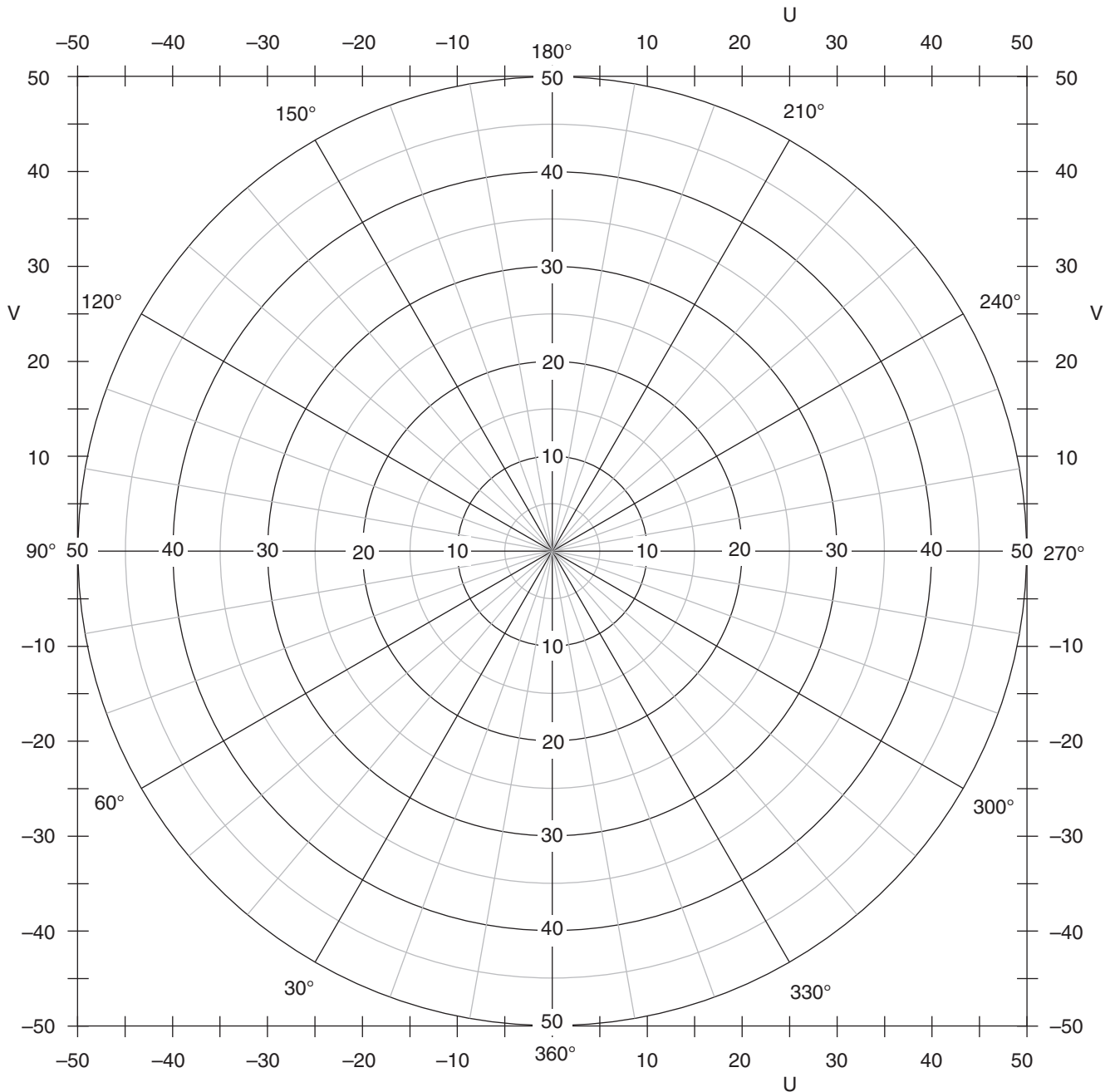*Blank hodograph for you to copy and use. Compass angles are direction winds are <u>from</u>. Speed-circle labels can be changed for different units or larger values, if needed.*

LAST NAME

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[ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]
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FIRST NAME

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[ ][ ][ ][ ][ ][ ][ ][ ][ ]
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Answer bubbles A–Z for each letter column of the name fields.

ID NUMBER

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[ ][ ][ ][ ][ ][ ]
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Digits 0–9 for each column.

TEST FORM

● B   ○ C   ○ D

#	A B C D E	#	A B C D E	#	A B C D E
1	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	36	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	71	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
2	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	37	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	72	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
3	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	38	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	73	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
4	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	39	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	74	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
5	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	40	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	75	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
6	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	41	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	76	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
7	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	42	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	77	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
8	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	43	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	78	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
9	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	44	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	79	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
10	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	45	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	80	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
11	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	46	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	81	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
12	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	47	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	82	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
13	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	48	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	83	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
14	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	49	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	84	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
15	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	50	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	85	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
16	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	51	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	86	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
17	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	52	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	87	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
18	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	53	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	88	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
19	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	54	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	89	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
20	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	55	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	90	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
21	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	56	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	91	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
22	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	57	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	92	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
23	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	58	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	93	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
24	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	59	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	94	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
25	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	60	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	95	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
26	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	61	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	96	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
27	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	62	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	97	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
28	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	63	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	98	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
29	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	64	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	99	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
30	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	65	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	100	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ
31	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	66	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		
32	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	67	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		
33	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	68	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		
34	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	69	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		
35	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ	70	Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ		