ATSC 201 **Midterm Exam** Name: _____
Prof. Stull (open books, notes, calculator)
Fall 2017 (50 points ≈ 1 minute/point) Student Number: _____

Use the attached "bubble sheet" to indicate your answers IN PENCIL. Be sure to put your name and student number on all sheets. You will turn in ALL sheets. If you make a mistake and change your answer on the bubble sheet, please thoroughly and cleanly erase the old wrong answer.
••••••••

(4 points) Plot this environmental sounding on the enclosed tephigram. Use this sounding for the next 10 questions. Assume the environment is dry.

P (kPa)	T (°C)
20	-40
35	-40
51	0
70	0
89	20
100	20

Answer the following questions on the bubble sheet.

1. (1 points) The static stability at P = 95 kPa is: A) stable B) neutral C) unstable D) unable to determine

2. (1 points) The static stability at P = 58 kPa is: A) stable B) neutral C) unstable D) unable to determine

3. (1 points) The tropopause is at P (kPa) ≈: A) 100 B) 70 C) 55 D) 35 E) 20

(1 points) Suppose that there is an air parcel near the ground of (P, T, Td) = (100 kPa, 40°C, 10°C). Plot this air parcel on the tephigram. Use this parcel for the next 5 questions.

4. (1 points) For this air parcel, the relative humidity (%) ≈: A) 8 B) 10 C) 16 D) 40 E) 48

5. (1 points) The LCL for this air parcel is at P (kPa) ≈: A) 89 B) 75 C) 70 D) 65 E) 55

6. (2 points) Assume the air parcel given above is in the environment of the sounding that you already plotted, to answer the next few questions.
The LFC for this parcel is at P (kPa) ≈: A) 71 B) 61 C) 51 D) 41 E) 31

7. (2 points) The EL for this parcel is at P(kPa) ≈ A) 58 B) 48 C) 38 D) 28 E) 18

8. (4 points) Estimating areas by eye (you do not need to calculate exact areas), which statement is TRUE regarding this air parcel in this environment?
A) CAPE > CIN B) CAPE ≈ CIN C) CAPE < CIN
D) a trigger is NOT needed to initiate a thunderstorm E) none of the previous choices are TRUE

9. (4 points) For the sounding at P = 80 kPa, assume the air is dry. The Brunt-Vaisala oscillation <u>period</u> (in seconds) for environmental air at that pressure is: A) 0 B) 25 C) 565.5 D) 2300 E) ∞

10. (2 points) The potential temperature of environmental air at 70 kPa is (°C) ≈
A) 0 B) 5 C) 15 D) 20 E) 30

Name: _____ SN: _____

11. (2 points) Which statement is FALSE regarding heat and moisture budgets:
A) Advective effects do not appear in Lagrangian budgets.
B) The Eulerian surface heat budget is driven by the surface net-radiation budget.
C) An air parcel will get warmer if it is sinking adiabatically (i.e., no thermal energy transfer to/from it).
D) On a clear summer day, solar radiative heating of the air is negligible.
E) Precipitation falling into a saturated volume of air will cause water vapour mixing ratio to increase.

(2 points) Plot the following sounding on the attached hodograph:

z (km)	wind direction (°)	wind speed (m/s)
0	0	0
1	120	5
2	150	10
3	180	15
4	210	20
5	240	25
6	270	40

(1 point) Also, assume the "normal" storm motion for this case is 230° at 12 m/s. Also plot this as an "X".

12. (1 point) The air at z = 3 km is moving toward the: A) north B) east C) south D) west E) (not moving)

13. (2 points) The total shear magnitude (using vector wind difference in m/s as a surrogate) is ≈:
A) 12 B) 23 C) 35 D) 40 E) 65

14. (4 points) A right-moving supercell would move from what direction and speed? (°, m/s) ≈
A) (212, 18) B) (230, 12) C) (250, 8) D) (270, 10) E) (298, 8)

15. (3 points) The pressure gradient at 70°N is $\Delta P/\Delta y = -5$ kPa/ 1000 km at sea level. The geostrophic wind (direction °, speed m/s) ≈: A) (270, 30) B) (90, 30) C) (0, 30) D) (180, 30) E) (not A, B, C, D)

16. (1 points) Which is TRUE regarding winds around a tornado? The winds are approximately
A) geostrophic B) boundary-layer gradient C) cyclostrophic D) antitriptic E) inertial

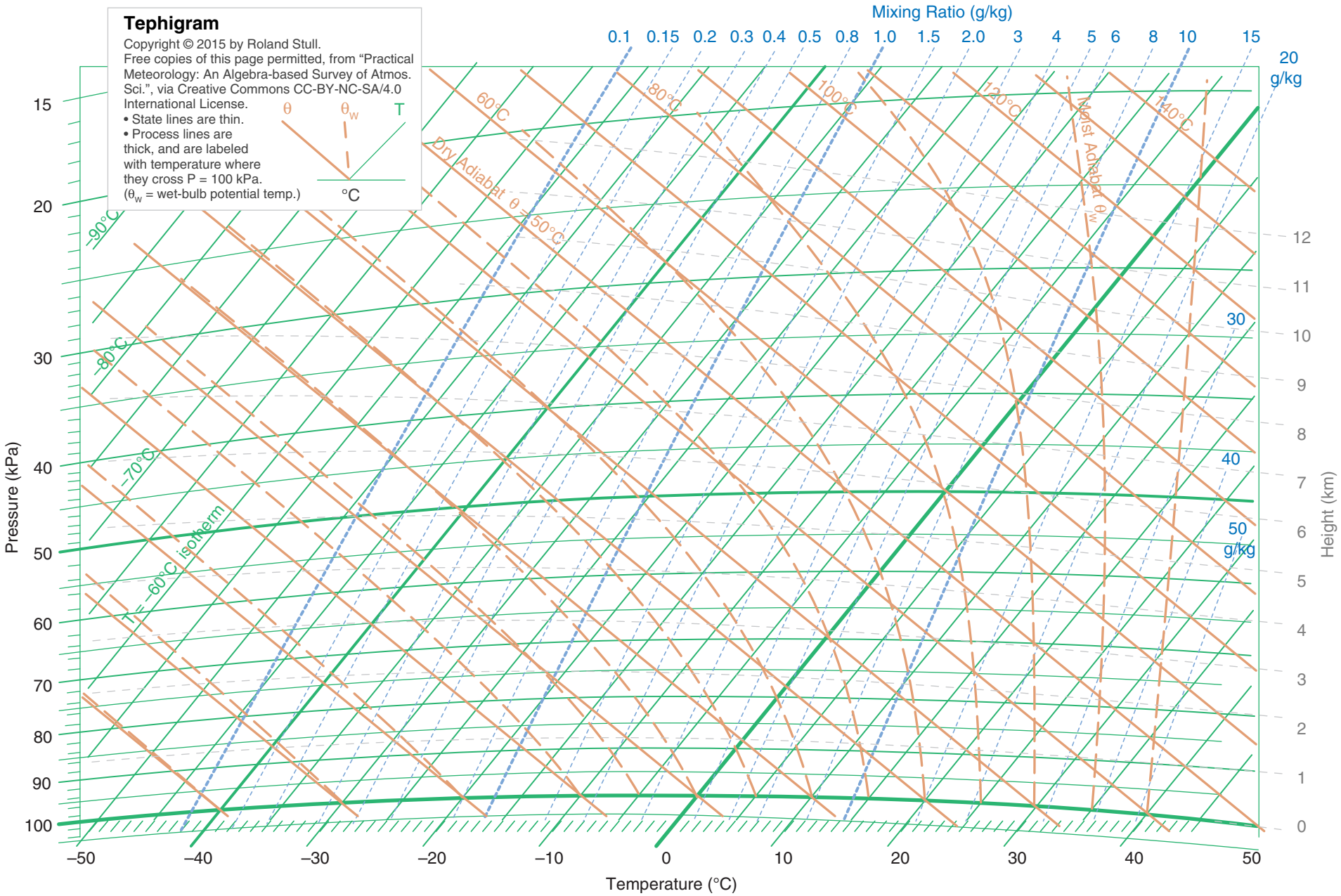
17. (2 points) Given a column of air with initially positive potential vorticity. Which statement is FALSE regarding frictionless flow? A) potential vorticity is conserved. B) relative vorticity is positive. C) relative vorticity will increase if the air column moves toward the north. D) relative vorticity will increase if the air column stretches in the vertical. E) absolute vorticity is not conserved.

18. (2 points) For warmer air, the hypsometric equation says that pressure ____ for cooler air.
A) decreases more rapidly with height than B) increases more rapidly with height than
C) varies nearly the same with height as D) increases more slowly with height than E) decreases more slowly with height than

19. (2 points) Storm-relative helicity is similar to relative vorticity but with the additional effect of
A) Doppler velocity B) Coriolis force C) suction vortices D) radial velocity E) vertical velocity

20. (4 points) Which would have the greatest effect in increasing the sunlight intercepted by the earth?
A) Increase sun's black-body temperature 5%. B) Decrease sun-earth distance by 5%. C) Increase earth diameter by 5%. D) Decrease earth's reflectivity by 5%. E) Decrease earth's rotation rate by 5%.

--end-- Attachments: tephigram, hodograph, bubble page. (Write your name & SN on ALL pages & submit.)


Tephigram
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• State lines are thin.
• Process lines are thick, and are labeled with temperature where they cross P = 100 kPa.
(θw = wet-bub potential temp.)
θ θw T
°C
Mixing Ratio (g/kg)
0.1 0.15 0.2 0.3 0.4 0.5 0.8 1.0 1.5 2.0 3 4 5 6 8 10 15 20 g/kg
60°C
80°C
100°C
120°C
140°C
Dry Adiabat θ
Moist Adiabat θw
−90°C
−80°C
−70°C
T = −60°C isotherm
30
40
50 g/kg
Pressure (kPa)
15 20 30 40 50 60 70 80 90 100
Height (km)
0 1 2 3 4 5 6 7 8 9 10 11 12
−50 −40 −30 −20 −10 0 10 20 30 40 50
Temperature (°C)

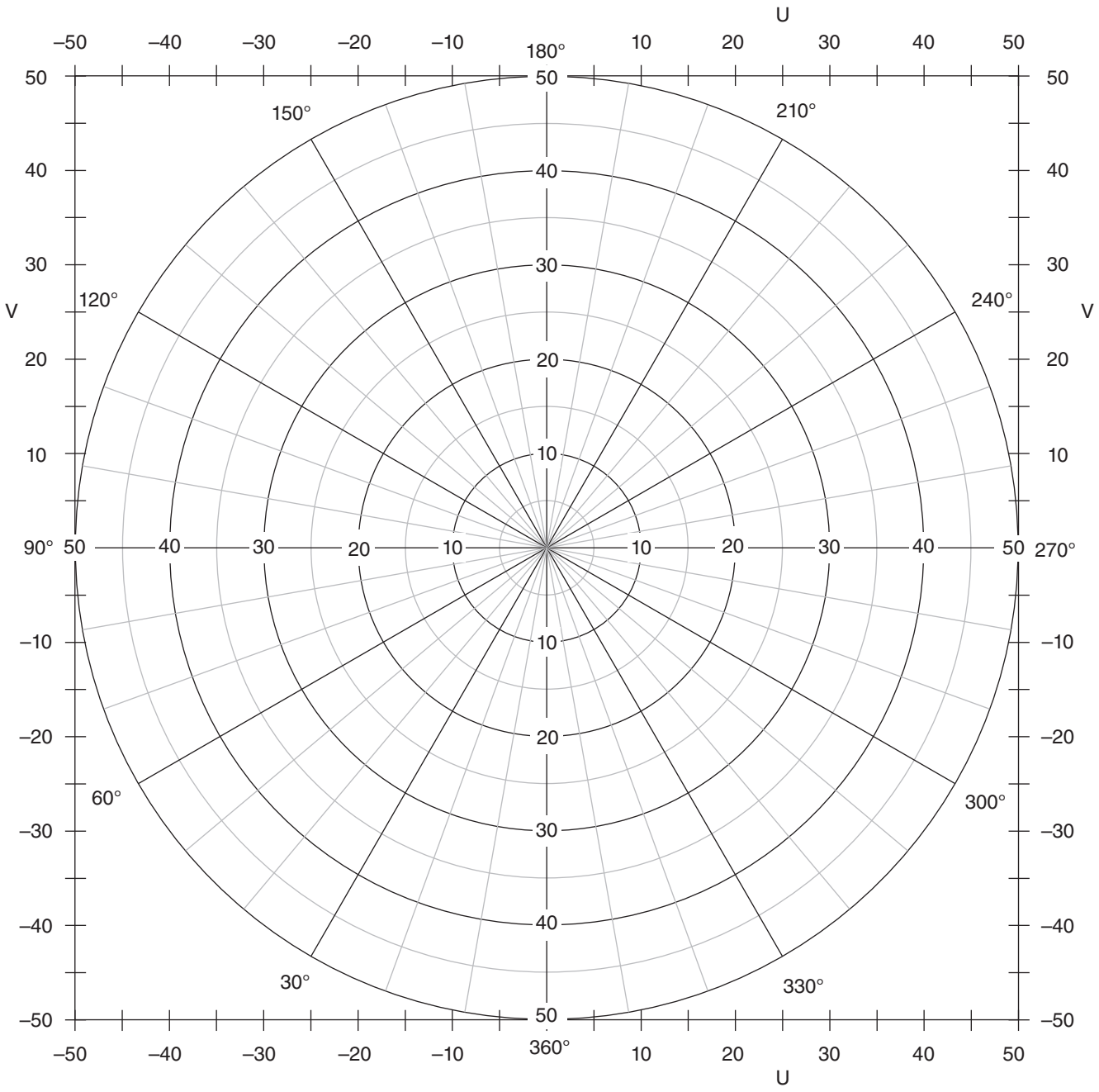
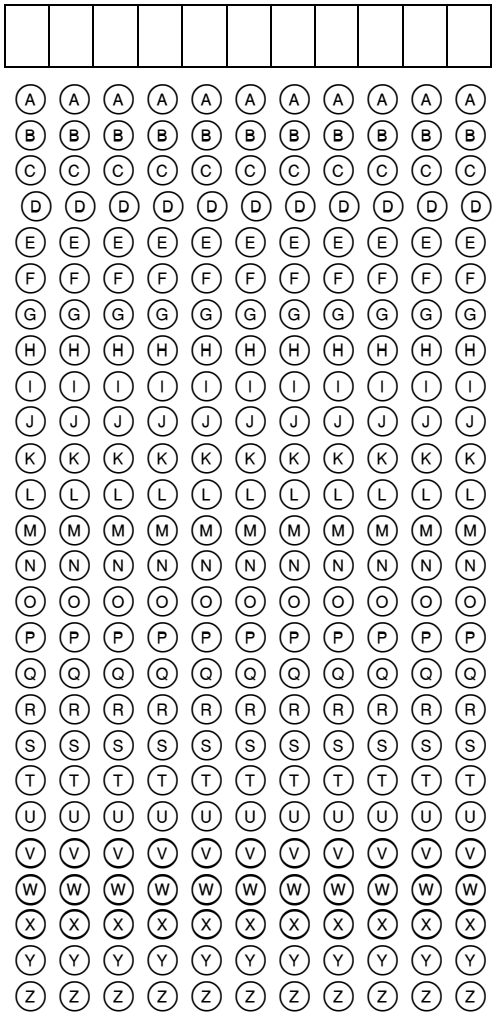
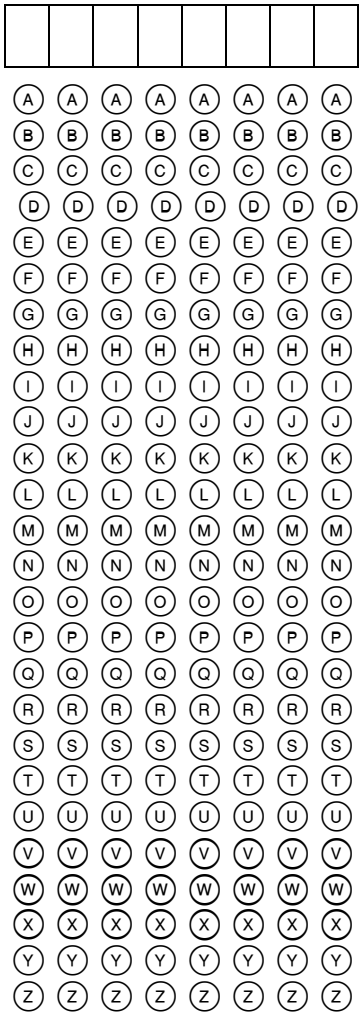


Figure 14.51
Blank hodograph for you to copy and use. Compass angles are direction winds are from. Speed-circle labels can be changed for different units or larger values, if needed.

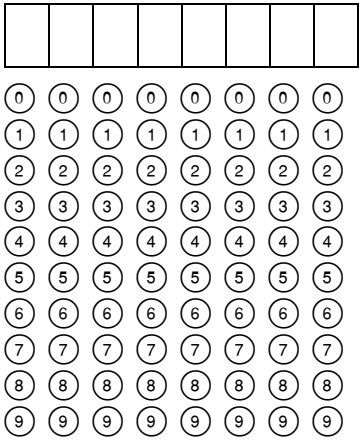
LAST NAME



FIRST NAME



ID NUMBER



TEST FORM

● B C D

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