

Quiz 2 sample

H 2.1	Pauling Electronegativity						
Li 1.0	Be 1.5	B 2.0	C 2.5	N 3.0	O 3.5	F 4.0	
Na 0.9	Mg 1.2	Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0	
K 0.8	Ca 1.0	Ga 1.6	Ge 1.8	As 2.0	Se 2.4	Br 2.8	
Rb 0.8	Sr 1.0	In 1.7	Sn 1.8	Sb 1.8	Te 2.1	I 2.5	
Cs 0.7	Ba 0.9	Tl 1.8	Pb 1.9	Po 1.9	At 2.0		2.2

Useful units

Avogadro number $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$

Gas constant (SI) $R = 8.3145 \text{ J mol}^{-1} \text{ K}^{-1}$

Gas constant $R = 0.08206 \text{ L atm mol}^{-1} \text{ K}^{-1}$

1 atm = 101 325 Pa = 760 mm Hg

1 m³ = 10³ L

...Together At Work



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Q1 Consider the Lewis structure and the VSEPR-geometry of these molecules and decide which molecule has a linear structure.

- a) HCN
- b) NH₄⁺
- c) CO₃²⁻
- d) SeF₂
- e) H₂O

Q2 Complete the Lewis structure of the I₃⁻-ion and identify the appropriate hybridization of the central I-atom

- a) sp
- b) sp²
- c) sp³
- d) dsp³
- e) d²sp³
- f) none of the above

I₃⁻-ion:



...Together At Work

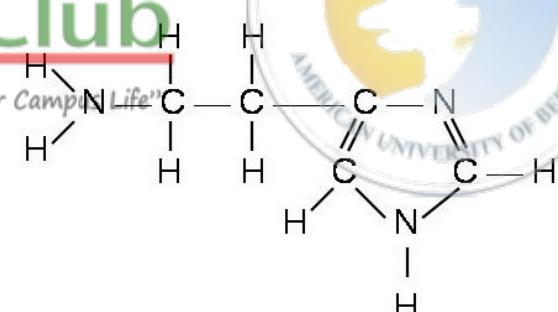
Q3 For which of these molecules do you predict the smallest bond angle?

- a) CH₄
- b) NH₃
- c) H₂S
- d) CCl₄
- e) SiF₄

Q4 As a response to allergens the body produces histamine. Complete the Lewis structure. How many sp³ hybridized carbon atoms do you identify in this molecule?

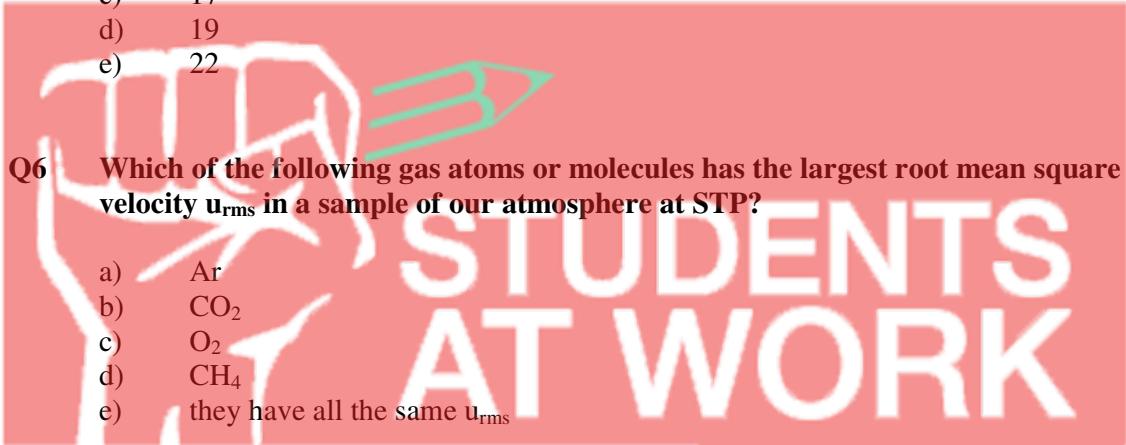
- a) 2
- b) 3
- c) 4
- d) 5
- e) none

Histamine:



Q5 How many σ -bonds do you identify in the Histamine molecule?

- a) 2
- b) 15
- c) 17
- d) 19
- e) 22



Q6 Which of the following gas atoms or molecules has the largest root mean square velocity u_{rms} in a sample of our atmosphere at STP?

- a) Ar
- b) CO₂
- c) O₂
- d) CH₄
- e) they have all the same u_{rms}

Q7 Argon effuses into a vacuum with a rate of 20mL/min. An unknown gas under the same conditions effuses with a rate of 30.7mL /min. Which one of the following gases could it be?

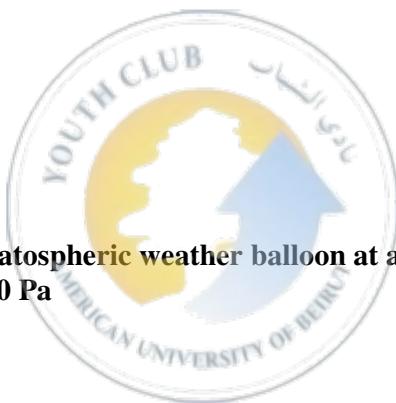
- a) Ne
- b) He
- c) NH₃
- d) UF₆
- e) H₂

Q8 Calculate the average kinetic energy of Methane (CH₄) in J/mol at t = 25° C, P=1 atm

- a) 3717 J/mol
- b) 311 J/mol
- c) 2477 J/mol
- d) 22.4 J/mol
- e) 36.68 J/mol

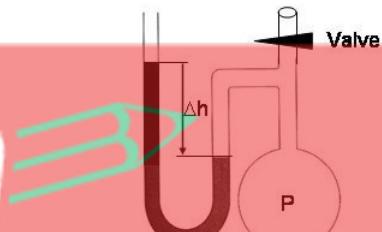
Q9 What is the density in g/L of Helium (He) in a stratospheric weather balloon at an altitude of ca 15,000 m; t = - 43 °C, and P = 66,000 Pa
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- a) 0.138 g/L
- b) 14.01 g/L
- c) 138 g/L
- d) 0.000117 g/L
- e) Additional information is needed



Q10 What is the pressure in the closed container when you read a Δh of 125 mm on the open u-tube manometer filled with mercury at an atmospheric pressure of 101325 Pa?

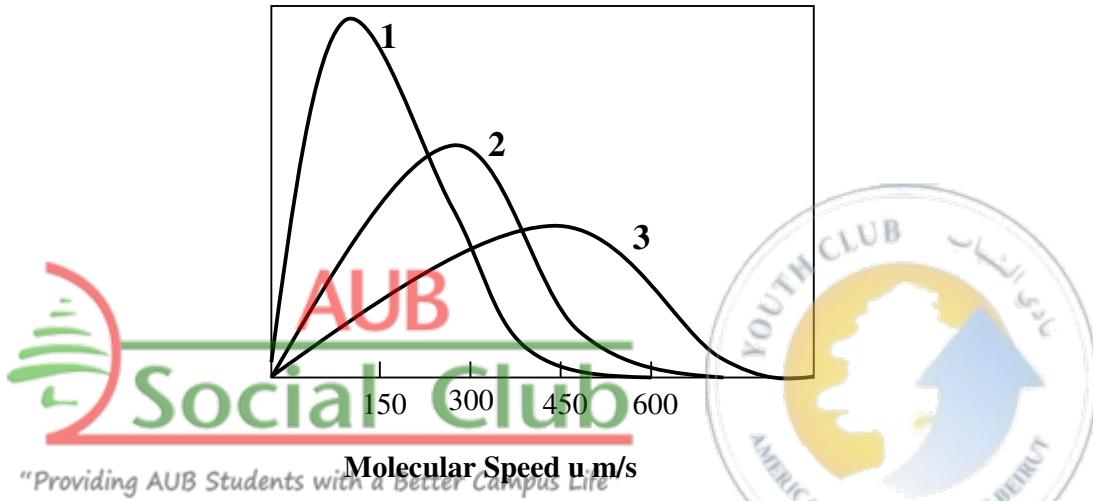
- a) 117990 Pa
- b) 84659 Pa
- c) 16665 Pa
- d) 125 torr
- e) 760 torr



Q11 The a value in the van der Waals equation for Xe is ____ than Ne. The b value of Ne is ____ than Ar. Fill in the blanks using the words, respectively:

- a) larger, larger
- b) larger, smaller
- c) smaller, larger
- d) smaller, smaller
- e) cannot be answered based on the information given

Q12 Which one of the following statements *can be deduced* from the molecular distribution of speed graphs shown below, corresponding to 3 different gases having different molar masses M; the y-axis corresponds to the fraction of molecules with a particular speed:



- a) The average kinetic energy per mole of gas must be different for the three gases.
- b) $M_1 < M_2 < M_3$ (M is the molar mass).
- c) The temperature of Gas 3 must be higher than the temperature of Gas 1, otherwise its distribution function cannot be broader as shown.
- d) The molecules of Gas 2 move at a speed of 300 m/s and collide with each other, as a result the molecules undergo only a change in direction. The pressure exerted on the wall is a function of the frequency of collisions and the speed at which the particles are moving.
- e) All are false

Q13 Consider CO₂ and Ne under the following conditions:

<u>Flask A, CO₂ (g)</u>	<u>Flask B, Ne (g)</u>
2 moles	3 moles
740 K	370 K
0.50 atm	0.80 atm

Which of the following statements is true?

- a) The volume CO₂ occupies is twice the volume occupied by Ne.
- b) The force exerted when a CO₂ molecule collides with the walls is smaller than the force exerted when a Ne molecule collides with the walls.
- c) The average kinetic of a Ne molecule is twice the average kinetic energy of CO₂ molecule.
- d) The u_{rms} for the CO₂ molecules is smaller than the u_{rms} for the Ne molecules.
- e) All are false

Q14 The valve between a 10-L tank containing a gas at 1 atm and a 3-L tank containing a gas at 0.5 atm is opened. Nothing else is changed in the environment. The two gases do not react. Calculate the final pressure in the tank:

- a) 0.88 atm
- b) 1.5 atm
- c) 2.45 atm
- d) 0.75 atm
- e) Not enough information is given to solve for the final pressure.

Q15 The hybridization of I in ICl₄⁻ is:

- a) sp
- b) sp²
- c) sp³
- d) dsp²
- e) d²sp³

Q16 Which of the following molecules (C: central atom) contains the shortest C-O bond:

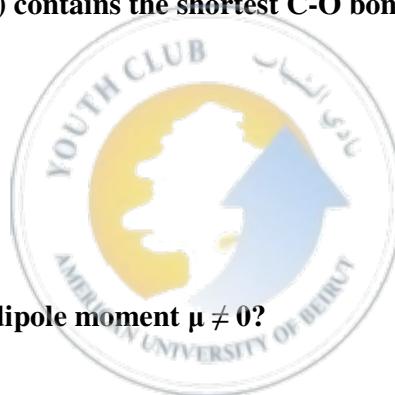
- a) CH₃OH
- b) CH₂O
- c) CO
- d) CO₂
- e) CH₃CH₂OH

Q17 Which of the following molecules has a resultant dipole moment $\mu \neq 0$?

- a) CHCl₃
- b) BF₃
- c) TeF₄
- d) a and c
- e) all of the above

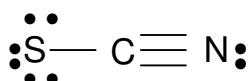


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Q18 Which of the following is expected to be the best resonance structure of SCN⁻

a)



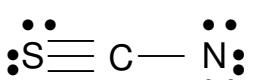
b)



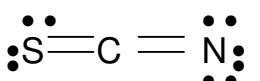
c)



d)



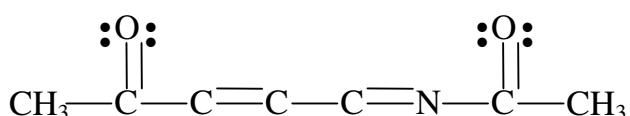
e)



19 Which of the following electron arrangement and molecular geometries around the central atom (1st atom is the central atom) correctly correspond to the molecule in question:

- a) CO₂, electron arrangement: trigonal planar; geometry: bent
- b) ClF₃, electron arrangement: octahedral; geometry: T-shaped
- c) XeCl₄, electron arrangement: trigonal bipyramidal; geometry: see-saw
- d) XeF₂, electron arrangement: trigonal bipyramidal; geometry: linear
- e) b and c are correct

Q20 How many atoms are in the same plane for the following molecule?



- a) 4
- b) 5
- c) 8
- d) 9
- e) 10

Periodic Table

Of The Elements

18

1

1	+1	H	20.056 14.025 0.0899 ^a	Oxidation states (bold is most stable state)	
2	+2	Ti	36.62 19.43 4.5	Density at 300 K (g/cm ³)	
3	+1	Li	16.15 45.4 0.53	Melting point (K) (Densities marked with n are 273 K and atm and the units are g/cm ³)	
4	+2	Be	17.45 1.85 Beryllium Lithium 9.012 182 ± 3	Boron Carbon Nitrogen Oxygen Fluorine Neon Tl = 7.467 ± 0.001 Fe = 55.848 ± 0.002	
5	+1	Na	11.56 13.63 0.97	[Atomic masses from pure Appl. Chem. 1996, 68, 2339]	
6	+2	Mg	20.99 24.305 0.16	[Atomic masses from pure Appl. Chem. 1996, 68, 2339]	
7	+3	Al	21	22	
8	+3	Si	22	23	
9	+3	P	24	25	
10	+2	S	25	26	
11	+2	Ca	21.04 18.12 40.078 34	27	28
12	+2	Sc	31.04 18.12 44.955 910 ± 8	+2.3	+2.3
13	+3	Ti	21.75 4.5	29	30
14	+3	V	29.45 5.8	+2.1	+2.1
15	+3	Cr	32.35 7.43	31	32
16	+3	Mn	33.5 11.80	+3	+4
17	+3	Fe	33.5 11.80	33	34
18	+3	Co	33.5 11.80	+3.5	+4.6
19	+1	K	31.02 33.6 11.12 0.86	35	36
20	+2	Ca	31.04 18.12 40.078 34	+2.3	+2.3
21	+3	Sc	31.04 18.12 44.955 910 ± 8	+2.1	+2.1
22	+3	Ti	21.75 4.5	37	38
23	+3	V	29.45 5.8	+2.3	+2.3
24	+3	Cr	32.35 7.43	+2.1	+2.1
25	+3	Mn	33.5 11.80	39	40
26	+3	Fe	33.5 11.80	+2.1	+2.1
27	+3	Co	33.5 11.80	41	42
28	+2.3	Cr	32.35 7.43	+2.3	+2.3
29	+2.3	Mn	33.5 11.80	43	44
30	+2.1	Fe	33.5 11.80	+2.1	+2.1
31	+2.1	Co	33.5 11.80	45	46
32	+2.1	Cr	32.35 7.43	+2.3	+2.3
33	+2.1	Mn	33.5 11.80	47	48
34	+2.1	Fe	33.5 11.80	+2.1	+2.1
35	+2.1	Co	33.5 11.80	49	50
36	+2.1	Cr	32.35 7.43	+2.3	+2.3
37	+2.1	Mn	33.5 11.80	51	52
38	+2.1	Fe	33.5 11.80	+2.1	+2.1
39	+3	Cr	32.35 7.43	53	54
40	+4	Mn	33.5 11.80	+2.1	+2.1
41	+5.3	Cr	32.35 7.43	+2.3	+2.3
42	+5.3	Mn	33.5 11.80	+2.1	+2.1
43	+5.3	Cr	32.35 7.43	+2.3	+2.3
44	+5.3	Mn	33.5 11.80	+2.1	+2.1
45	+5.3	Cr	32.35 7.43	+2.3	+2.3
46	+2.4	Cr	32.35 7.43	+2.3	+2.3
47	+1	Pd	42.93 12.0	+2.1	+2.1
48	+2	Ag	104.0 10.5	+2.1	+2.1
49	+3	Cd	104.0 12.0	+2.1	+2.1
50	+4.2	Ag	104.0 10.5	+2.1	+2.1
51	+3.5	In	104.0 12.0	+2.1	+2.1
52	+2.4	Sn	104.0 10.5	+2.1	+2.1
53	+1.5	Sb	104.0 10.5	+2.1	+2.1
54	+1.5	Te	104.0 10.5	+2.1	+2.1
55	+1	Rb	16.50 4.5	+2.1	+2.1
56	+2	Sr	16.50 4.5	+2.1	+2.1
57	+3	Y	16.50 4.5	+2.1	+2.1
58	+3	Ta	16.50 4.5	+2.1	+2.1
59	+3	W	16.50 4.5	+2.1	+2.1
60	+3	Re	16.50 4.5	+2.1	+2.1
61	+3	Os	16.50 4.5	+2.1	+2.1
62	+3	Ir	16.50 4.5	+2.1	+2.1
63	+3	Rh	16.50 4.5	+2.1	+2.1
64	+3	Pt	16.50 4.5	+2.1	+2.1
65	+3	Au	16.50 4.5	+2.1	+2.1
66	+3	Hg	16.50 4.5	+2.1	+2.1
67	+3	Tl	16.50 4.5	+2.1	+2.1
68	+3	Pb	16.50 4.5	+2.1	+2.1
69	+3	Bi	16.50 4.5	+2.1	+2.1
70	+3.2	Po	16.50 4.5	+2.1	+2.1
71	+3	At	16.50 4.5	+2.1	+2.1
72	+3	Rn	16.50 4.5	+2.1	+2.1
73	+3	Lu	16.50 4.5	+2.1	+2.1
74	+3	Er	16.50 4.5	+2.1	+2.1
75	+3	Ho	16.50 4.5	+2.1	+2.1
76	+3	Tm	16.50 4.5	+2.1	+2.1
77	+3	Dy	16.50 4.5	+2.1	+2.1
78	+2.4	Tb	16.50 4.5	+2.1	+2.1
79	+2.4	Gd	16.50 4.5	+2.1	+2.1
80	+2.1	Eu	16.50 4.5	+2.1	+2.1
81	+2.1	Sm	16.50 4.5	+2.1	+2.1
82	+2.1	Pr	16.50 4.5	+2.1	+2.1
83	+2.1	Nd	16.50 4.5	+2.1	+2.1
84	+2.1	Di	16.50 4.5	+2.1	+2.1
85	+2.1	Eu	16.50 4.5	+2.1	+2.1
86	+2.1	Eu	16.50 4.5	+2.1	+2.1
87	+2	Rf	16.50 4.5	+2.1	+2.1
88	+2	Ac	16.50 4.5	+2.1	+2.1
89	+3	Rb	16.50 4.5	+2.1	+2.1
90	+4	Fr	16.50 4.5	+2.1	+2.1
91	+5.3	Ra	16.50 4.5	+2.1	+2.1
92	+5.3	Ac	16.50 4.5	+2.1	+2.1
93	+6.3	Rf	16.50 4.5	+2.1	+2.1
94	+6.3	Db	16.50 4.5	+2.1	+2.1
95	+6.3	Db	16.50 4.5	+2.1	+2.1
96	+3	Gd	16.50 4.5	+2.1	+2.1
97	+4.3	Tb	16.50 4.5	+2.1	+2.1
98	+4.3	Eu	16.50 4.5	+2.1	+2.1
99	+4.3	Sm	16.50 4.5	+2.1	+2.1
100	+4.3	Pr	16.50 4.5	+2.1	+2.1
101	+4.3	Eu	16.50 4.5	+2.1	+2.1
102	+4.3	Eu	16.50 4.5	+2.1	+2.1
103	+4.3	Eu	16.50 4.5	+2.1	+2.1
104	+4.3	Eu	16.50 4.5	+2.1	+2.1
105	+4.3	Eu	16.50 4.5	+2.1	+2.1
106	+4.3	Eu	16.50 4.5	+2.1	+2.1
107	+4.3	Eu	16.50 4.5	+2.1	+2.1
108	+4.3	Eu	16.50 4.5	+2.1	+2.1
109	+4.3	Eu	16.50 4.5	+2.1	+2.1
110	+4.3	Eu	16.50 4.5	+2.1	+2.1
111	+4.3	Eu	16.50 4.5	+2.1	+2.1
112	+4.3	Eu	16.50 4.5	+2.1	+2.1
113	+4.3	Eu	16.50 4.5	+2.1	+2.1
114	+4.3	Eu	16.50 4.5	+2.1	+2.1
115	+4.3	Eu	16.50 4.5	+2.1	+2.1
116	+4.3	Eu	16.50 4.5	+2.1	+2.1
117	+4.3	Eu	16.50 4.5	+2.1	+2.1
118	+4.3	Eu	16.50 4.5	+2.1	+2.1
119	+4.3	Eu	16.50 4.5	+2.1	+2.1
120	+4.3	Eu	16.50 4.5	+2.1	+2.1
121	+4.3	Eu	16.50 4.5	+2.1	+2.1
122	+4.3	Eu	16.50 4.5	+2.1	+2.1
123	+4.3	Eu	16.50 4.5	+2.1	+2.1
124	+4.3	Eu	16.50 4.5	+2.1	+2.1
125	+4.3	Eu	16.50 4.5	+2.1	+2.1
126	+4.3	Eu	16.50 4.5	+2.1	+2.1
127	+4.3	Eu	16.50 4.5	+2.1	+2.1
128	+4.3	Eu	16.50 4.5	+2.1	+2.1
129	+4.3	Eu	16.50 4.5	+2.1	+2.1
130	+4.3	Eu	16.50 4.5	+2.1	+2.1
131	+4.3	Eu	16.50 4.5	+2.1	+2.1
132	+4.3	Eu	16.50 4.5	+2.1	+2.1
133	+4.3	Eu	16.50 4.5	+2.1	+2.1
134	+4.3	Eu	16.50 4.5	+2.1	+2.1
135	+4.3	Eu	16.50 4.5	+2.1	+2.1
136	+4.3	Eu	16.50 4.5	+2.1	+2.1
137	+4.3	Eu	16.50 4.5	+2.1	+2.1
138	+4.3	Eu	16.50 4.5	+2.1	+2.1
139	+4.3	Eu	16.50 4.5	+2.1	+2.1
140	+4.3	Eu	16.50 4.5	+2.1	+2.1
141	+4.3	Eu	16.50 4.5	+2.1	+2.1
142	+4.3	Eu	16.50 4.5	+2.1	+2.1
143	+4.3	Eu	16.50 4.5	+2.1	+2.1
144	+4.3	Eu	16.50 4.5	+2.1	+2.1
145	+4.3	Eu	16.50 4.5	+2.1	+2.1
146	+4.3	Eu	16.50 4.5	+2.1	+2.1
147	+4.3	Eu	16.50 4.5	+2.1	+2.1
148	+4.3	Eu	16.50 4.5	+2.1	+2.1
149	+4.3	Eu	16.50 4.5	+2.1	+2.1
150	+4.3	Eu	16.50 4.5	+2.1	+2.1
151	+4.3	Eu	16.50 4.5	+2.1	+2.1
152	+4.3	Eu	16.50 4.5	+2.1	+2.1
153	+4.3	Eu	16.50 4.5	+2.1	+2.1
154	+4.3	Eu	16.50 4.5	+2.1	+2.1
155	+4.3	Eu	16.50 4.5	+2.1	+2.1
156	+4.3	Eu	16.50 4.5	+2.1	+2.1
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158	+4.3	Eu	16.50 4.5	+2.1	+2.1
159	+4.3	Eu	16.50 4.5	+2.1	+2.1
160	+4.3	Eu	16.50 4.5	+2.1	+2.1
161	+4.3	Eu	16.50 4.5	+2.1	+2.1
162	+4.3	Eu	16.50 4.5	+2.1	+2.1
163	+4.3	Eu	16.50 4.5	+2.1	+2.1
164	+4.3	Eu	16.50 4.5	+2.1	+2.1
165	+4.3	Eu	16.50 4.5	+2.1	+2.1
166	+4.3	Eu	16.50 4.5	+2.1	+2.1
167	+4.3	Eu	16.50 4.5	+2.1	+2.1
168	+4.3	Eu	16.50 4.5	+2.1	+2.1
169	+4.3	Eu	16.50 4.5	+2.1	+2.1
170	+4.3	Eu	16.50 4.5	+2.1	+2.1
171	+4.3	Eu	16.50 4.5	+2.1	+2.1
172	+4.3	Eu	16.50 4.5	+2.1	+2.1
173	+4.3	Eu	16.50 4.5	+2.1	+2.1
174	+4.3	Eu	16.50 4.5	+2.1	+2.1
175	+4.3	Eu	16.50 4.5	+2.1	+2.1
176	+4.3	Eu	16.50 4.5	+2.1	+2.1
177	+4.3	Eu	16.50 4.5	+2.1	+2.1
178	+4.3	Eu	16.50 4.5	+2.1	+2.1
179	+4.3	Eu	16.50 4.5	+2.1	+2.1
180	+4.3	Eu	16.50 4.5	+2.1	+2.1
181	+4.3	Eu	16.50 4.5	+2.1	+2.1
182	+4.3	Eu	16.50 4.5	+2.1	+2.1
183	+4.3	Eu	16.50 4.5	+2.1	+2.1
184	+4.3	Eu	16.50 4.5	+2.1	+2.1
185	+4.3	Eu	16.50 4.5	+2.1	+2.1
186	+4.3	Eu	16.50 4.5	+2.1	+2.1
187	+4.3	Eu	16.50 4.5	+2.1	+2.1
188	+4.3	Eu	16.50 4.5	+2.1	+2.1
189	+4.3	Eu	16.50 4.5	+2.1	+2.1
190	+4.3	Eu	16.50 4.5	+2.1	+2.1
191	+4.3	Eu	16.50 4.5	+2.1	+2.1
192	+4.3	Eu	16.50 4.5	+2.1	+2.1
193	+4.3	Eu	16.50 4.5	+2.1	