

Fig.S1

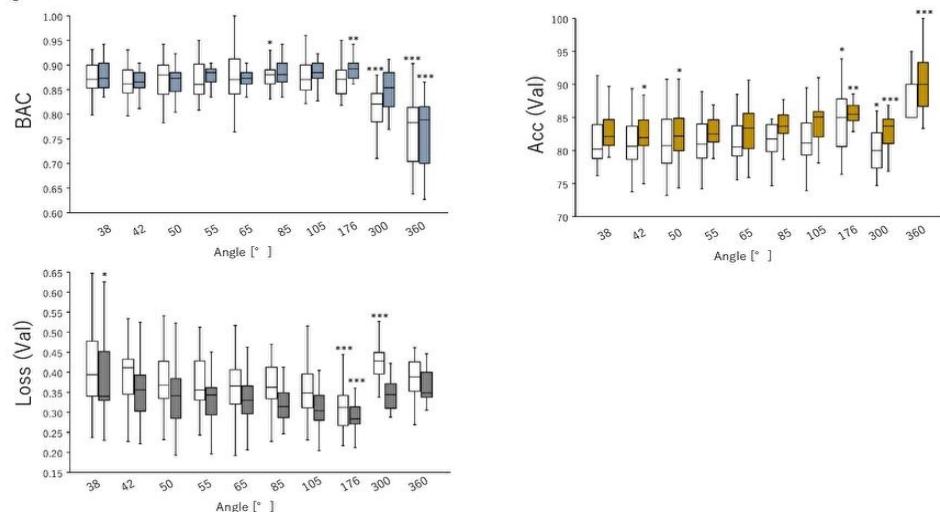


Figure S1. Prediction performance at different snapshot angles by DeepSnap. For each of the 10 angles ($38^\circ, 42^\circ, 50^\circ, 55^\circ, 65^\circ, 85^\circ, 105^\circ, 176^\circ, 300^\circ, 360^\circ$), an unfilled box (left) and a filled box (right) indicate datasets ratios Tra:Val:Test = 1:1:1 and 2:2:1, respectively. The means of MMC, F, Acc (Test), AUC, Acc (Val), Loss (Val), and BAC were calculated by 25-fold. * : $p < .05$, * * : $p < .01$, ** * : $p < .001$.

Fig.S2

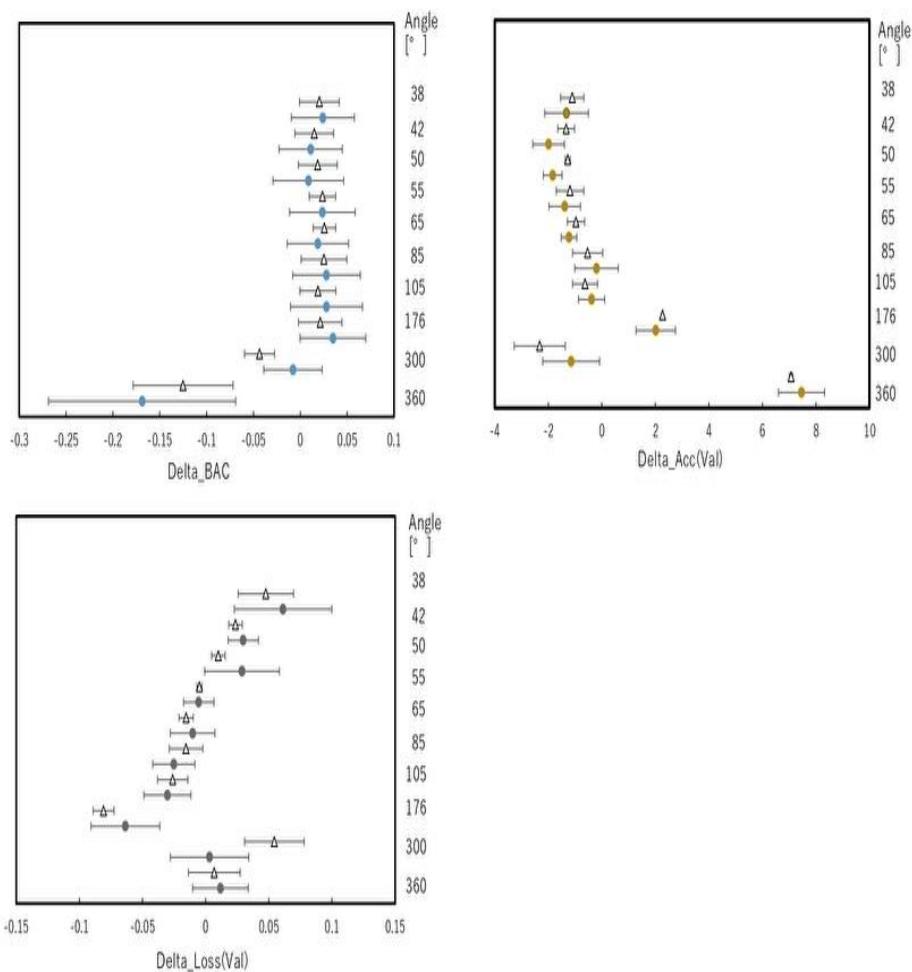


Figure S2. Differences in the mean levels of performance of DeepSnap at different angles. Differences in the mean values of the performance indicators between one angle and the other nine angles, denoted as Delta_Acc (Val), Delta_Loss (Val), and Delta_BAC, were calculated based on the results shown in Fig. S1, with a 95% confident interval (CI) as error bars. The filled dots and unfilled triangles indicate the dataset ratios Tra: Val: Test = 1: 1: 1 and 2: 2: 1, respectively.

Fig.S3

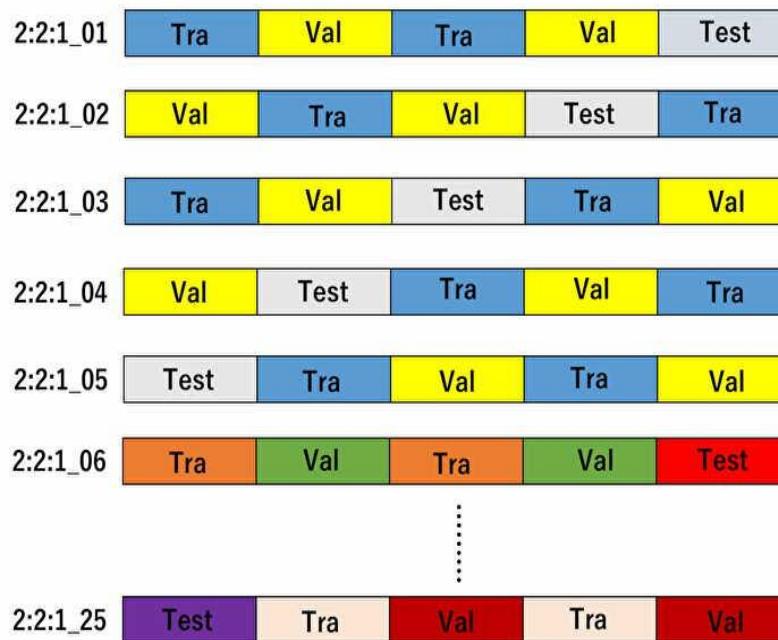


Figure S3. Preparation of dataset split into Tra, Val, and Test. Three dataset groups, including Tra, Val, and Test, were then built with a ratio of 2:2:1. A prediction model was created by the Tra ad Val datasets, respectively. Finally, prediction performance was calculated by using the Test dataset (2:2:1_01). Finally, a total of 25 tests were performed (2:2:1_25).

Table S1a. Optimization of the solver types in hyperparameters

Solver Type	Loss (Val)	Acc (Val)
NAG	0.259221	87.1231
AdaGrad	0.273683	83.7705
AdaDelta	0.410498	80.9836
Adam	0.344194	85.5738
RMSprop	0.317712	87.7049
SDG	0.313697	83.9753
Angle:176° , BT:40, LR:0.001		
Most high-performance of each Solver types were indicated by bold.		

Table S1b. Optimization of the Learning rates and Batch sizes in hyperparameters with Loss (Val)								
	LRs	LRs	LRs	LRs	LRs	LRs	LRs	LRs
BSs	0.0025	0.0024	0.0023	0.0022	0.0021	0.0020	0.0019	0.0018
35	0.187423	0.182966	0.189255	0.187056	0.183283	0.187059	0.178084	0.186253
36	0.177527	0.189400	0.187449	0.185641	0.184379	0.186366	0.188569	0.190117
37	0.146634	0.154745	0.153164	0.154488	0.154003	0.153302	0.154567	0.152418
38	0.171144	0.171241	0.170632	0.171688	0.174109	0.173029	0.173709	0.171152
39	0.155759	0.159271	0.157051	0.156157	0.158705	0.159942	0.159590	0.158212
40	0.164046	0.167822	0.168609	0.173596	0.172465	0.170931	0.171160	0.168201

LRs: learning rates, BSs:Batch sizes
Angle:176° , Solver type: NAG
Most high-performance of each predictions were indicated by bold.

Table S1c. Optimization of the Learning rates and Batch sizes in hyperparameters with Acc (Val)								
	LRs	LRs	LRs	LRs	LRs	LRs	LRs	LRs
BSs	0.0025	0.0024	0.0023	0.0022	0.0021	0.0020	0.0019	0.0018
35	91.8804	91.4529	90.5983	91.2393	91.0257	88.2479	91.2393	91.4529
36	91.7211	91.0676	91.2854	91.0676	90.6318	90.4140	90.6318	90.6318
37	94.0816	92.4490	93.2653	92.8572	93.0612	92.6531	92.6531	92.6531
38	92.2917	92.2917	92.2917	92.2917	92.2917	90.8333	91.4583	91.4583
39	92.5532	92.1277	91.7021	92.1277	92.3404	91.0638	91.9149	92.3404
40	92.8261	92.8261	92.0913	92.6087	91.0869	92.8261	91.9565	93.2609

LRs: learning rates, BSs:Batch sizes
Angle:176° , Solver type: NAG
Most high-performance of each predictions were indicated by bold.

Table S2. Performance of prediction models with thresholds of Max score.											
Max Score	average Loss(Val) ± SD			average Acc(Val) ± SD			average BAC ± SD			average F ± SD	
0.10	0.221	±	0.050		93.453	±	1.782		0.878	±	0.096
0.15	0.301	±	0.065		88.561	±	2.232		0.804	±	0.077
0.20	0.342	±	0.049		82.284	±	2.869		0.851	±	0.056
0.30	0.325	±	0.029		82.272	±	2.645		0.903	±	0.036
0.35	0.279	±	0.030		86.756	±	1.611		0.903	±	0.051
0.40	0.232	±	0.056		89.638	±	3.012		0.933	±	0.040
0.45	0.287	±	0.095		89.489	±	3.230		0.890	±	0.052
0.50	0.142	±	0.063		95.560	±	2.455		0.921	±	0.010
0.55	0.195	±	0.061		93.433	±	2.019		0.858	±	0.070
0.40PMT	0.666	±	0.013		61.431	±	4.672		0.594	±	0.107

Each average and standard deviation (SD) were calculated by 5-fold.
Most high-performance of prediction in each Max Scores were indicated by bold.
0.40PMT showed permutation test in 0.40 of Max Score.

Table S3a. Clustering analysis of principal components of molecular descriptors extracted by MOFRED from training dataset.

Cl. No.	variables No.	C001_Tra			C004_Tra			C013_Tra			C017_Tra			C024_Tra						
		variables	No.	Cluster	Total	variables	No.	Cluster	Total	variables	No.	Cluster	Total	variables	No.	Cluster	Total			
1	63	VR3_D	0.978	0.061	65	VR3_D	0.966	0.061	108	LogEE_A	0.888	0.092	68	nBonds	0.949	0.067	62	VR3_Dse	0.982	0.059
2	63	nBonds	0.938	0.058	66	VR1_Dp	0.936	0.06	92	nAtom	0.858	0.076	66	VR3_D	0.969	0.066	61	SxDiam_Dse	0.949	0.056
3	60	SxDiam_Dse	0.976	0.058	59	SxDiam_Dse	0.951	0.055	78	SxDiam_Dse	0.909	0.068	63	SxDiam_Dse	0.959	0.062	45	VRL_D	0.961	0.042
4	51	AT59d	0.962	0.048	44	Si	0.972	0.42	66	LogEE_Dt	0.841	0.053	48	VRL_Di	0.96	0.048	44	Spe	0.958	0.041
5	31	MFC5	0.903	0.028	32	AT51v	0.933	0.029	41	Sm	0.805	0.032	26	AT51v	0.935	0.025	34	AT55d	0.941	0.031
6	28	AT51Z	0.902	0.025	24	AAT51se	0.925	0.022	37	AAT51se	0.874	0.029	26	MFC5	0.903	0.024	26	AAT51se	0.904	0.023
7	27	MaE	0.898	0.024	25	Xp_7d	0.885	0.022	37	nBondsM	0.776	0.026	24	MaE	0.902	0.022	22	Sm	0.886	0.019
8	23	AT57d	0.934	0.021	22	SM1_Dp	0.904	0.019	36	SM1_Date	0.742	0.026	22	MWC10	0.917	0.021	19	AT57p	0.909	0.017
9	23	SM1_Dse	0.896	0.02	18	Xoc_4d	0.869	0.015	35	Mm	0.719	0.024	21	SM1_Date	0.952	0.018	17	Xp_5d	0.889	0.015
10	18	AT54dv	0.885	0.016	16	AT52z	0.91	0.014	27	MATSare	0.635	0.016	16	SZ	0.897	0.015	17	nAtomTom	0.871	0.014
means	38.7		0.927	0.036	37.1		0.925	0.072	55.7		0.795	0.044		38.0		0.924	0.037		34.7	
sd	18.3		0.055	0.018	19.8		0.034	0.124	23.3		0.087	0.026		20.9		0.037	0.021		17.4	
total	387		0.359	311	0.717		0.557		0.717		0.442			380		0.368	0.317		347	

Cl. No.: cluster number that is top 10 of clusters of percentage of total variation explained by each cluster component

variables No.: variables number that is number of variables belonging to each cluster

variables: representative variable with the largest square of correlation coefficient with cluster component

Fluctuation in Cluster: the percentage of fluctuation explained by their first PC of the fluctuations of variables belonging to the cluster

Fluctuation in Total: percentage of total variation explained by each cluster component

Table S9b. Clustering analysis of principal components of molecular descriptors extracted by MORDRED from Test datasets.

CL No.	variables No.	CV01_Test			CV02_Test			CV03_Test			CV04_Test			CV05_Test			
		Fluctuation			Fluctuation			Fluctuation			Fluctuation			Fluctuation			
		variables	No.	Cluster	Total	variables	No.	Cluster	Total	variables	No.	Cluster	Total	variables	No.	Cluster	
1	63	72	ATSSe	0.961	0.072	65	VR3_DZ	0.968	0.063	91	LogEE_Dpe	0.961	0.086	62	VR3_Dse	0.992	0.059
2	63	66	VR3_D	0.954	0.065	55	LogEE_Dij	0.975	0.054	84	nHeavyAtom	0.967	0.048	61	SpDiam_Dse	0.949	0.066
3	60	62	MID	0.946	0.061	49	VR1_D	0.963	0.047	60	Sse	0.966	0.057	45	VR1_Dse	0.961	0.042
4	51	52	LogEE_Dij	0.961	0.052	37	ATStp	0.968	0.036	56	LogEE_A	0.974	0.054	44	Spe	0.988	0.041
5	31	29	SM1_Dzare	0.878	0.026	36	ATSti	0.966	0.035	29	SM1_Dzare	0.913	0.026	34	ATStd	0.941	0.031
6	28	26	MPC5	0.888	0.024	34	ATStp	0.927	0.032	28	MPC2	0.927	0.026	26	ATStse	0.904	0.023
7	27	24	MW	0.887	0.022	26	TMPC10	0.909	0.036	23	MPC5	0.984	0.02	22	Sm	0.886	0.019
8	23	18	ATStope	0.931	0.017	24	ATStz	0.913	0.022	21	ATStope	0.907	0.019	19	ATStp	0.909	0.017
9	23	17	MWC09	0.932	0.016	25	ATStope	0.85	0.021	21	MWC10	0.896	0.019	17	Xp-Sd	0.899	0.015
10	18	18	nAtomAtom	0.895	0.016	24	ATStope	0.866	0.021	17	nAtomAtom	0.853	0.014	17	nAtomTom	0.871	0.014
means	38.7	38.4	0.918	0.037	37.5	0.930	0.036	43.0	0.935	0.040	34.7	0.926	0.032	41.5	0.932	0.039	
sd	18.3	22.0	0.043	0.023	14.4	0.043	0.015	27.7	0.042	0.027	17.4	0.037	0.017	24.6	0.042	0.024	
total	387	384		0.371	375	0.357	0.357	430	0.401	0.37	377	0.317	0.317	415	0.392	0.392	

CL No.: Cluster number that is top 10 of clusters of percentage of total variation explained by each cluster component

Variables No.: variables number that's number of variables belonging to each cluster

Variables: representative variable with the largest square of correlation coefficient with cluster component

Fluctuation in Cluster: the percentage of fluctuation explained by their first PC of the fluctuations of variables belonging to the cluster

Fluctuation in Total: percentage of total variation explained by each cluster component

Table S4. Chemical compounds used in this study

	SMILES
1.	CC(C)C(=O)c1ccc(C(=O)c2ccccc2)cc1
2.	CC(C)C(=O)c1ccc(C(=O)c2ccccc2)cc1
3.	CCCCC(COC(=O)c1ccccc1)(COC(=O)c1ccccc1)
4.	CCCCC(COC(=O)c1ccccc1)(COC(=O)c1ccccc1)
5.	Cc1ccccc1
6.	CCCCC(COC(=O)c1ccccc1)(COC(=O)c1ccccc1)
7.	CCCCC(COC(=O)c1ccccc1)(COC(=O)c1ccccc1)
8.	CCCCC(COC(=O)c1ccccc1)(COC(=O)c1ccccc1)
9.	CCCCC(COC(=O)c1ccccc1)(COC(=O)c1ccccc1)
10.	CCCCC(COC(=O)c1ccccc1)(COC(=O)c1ccccc1)
11.	CCCCC(COC(=O)c1ccccc1)(COC(=O)c1ccccc1)
12.	CCCCC(COC(=O)c1ccccc1)(COC(=O)c1ccccc1)
13.	0.970142321 N#Cc1ccccc1CN#
14.	0.983257034 Cc1ccccc1
15.	2.293864268 N~C=CCc1ccccc1N~c1ccccc1
16.	1.299148377 Bc1ccccc1C(=O)c1ccccc1
17.	0.835701879 Bc1ccccc1C(=O)c1ccccc1
18.	1.194246891 Bc1ccccc1
19.	0.983257034 Cc1ccccc1
20.	1.092444621 Cc1ccccc1
21.	1.041661001 Cc1ccccc1
22.	1.092444621 Cc1ccccc1
23.	0.999109881 Cc1ccccc1
24.	2.898772952 Cc1ccccc1
25.	0.894708941 Cc1ccccc1
26.	1.467026950 Cc1ccccc1
27.	1.299148377 Cc1ccccc1C(=O)c1ccccc1
28.	1.299148377 Cc1ccccc1C(=O)c1ccccc1
29.	1.299148377 Cc1ccccc1C(=O)c1ccccc1
30.	1.299148377 Cc1ccccc1C(=O)c1ccccc1
31.	1.299148377 Cc1ccccc1C(=O)c1ccccc1
32.	1.299148377 Cc1ccccc1C(=O)c1ccccc1
33.	1.299148377 Cc1ccccc1C(=O)c1ccccc1
34.	0.988139324 Cc1ccccc1
35.	1.299148377 Cc1ccccc1
36.	1.405778259 Cc1ccccc1
37.	0.848479106 (O)[N+](=O)[C]c1ccccc1[N+]([O-])n6c61[N+]([O-])[O-]
38.	1.299148377 Cc1ccccc1
39.	1.080082864 Bc1ccccc1
40.	1.299148377 Cc1ccccc1
41.	1.157935847 (O)[N+](=O)[C]c1ccccc1[N+]([O-])[O-]
42.	1.839195056 Cc1ccccc1
43.	1.299148377 Cc1ccccc1
44.	0.831977738 Cc1ccccc1
45.	1.299148377 Cc1ccccc1
46.	1.074027645 Cc1ccccc1
47.	1.061049414 Cc1ccccc1
48.	0.988139324 Cc1ccccc1
49.	1.276512928 Cc1ccccc1
50.	1.529512931 Cc1ccccc1
51.	1.819512931 Cc1ccccc1
52.	1.418193285 Cc1ccccc1
53.	1.299148377 Cc1ccccc1
54.	3.234103831 Cc1ccccc1
55.	1.012893948 Cc1ccccc1
56.	1.299148377 Cc1ccccc1
57.	0.468235456 Cc1ccccc1
58.	1.299148377 Cc1ccccc1
59.	1.173730703 Cc1ccccc1
60.	1.561256801 SC~INC2=C(N)C~CC~C2
61.	1.561256801 SC~INC2=C(N)C~CC~C2
62.	2.273356451 Sc1ccccc1
63.	1.240214436 Sc1ccccc1
64.	3.202127927 Cc1ccccc1
65.	1.020394287 Cc1ccccc1
66.	0.737047859 Cc1ccccc1
67.	1.018010417 Cc1ccccc1
68.	1.274942116 Cc1ccccc1
69.	0.848479106 Cc1ccccc1
70.	0.65176264 Nc1ccccc1
71.	1.299055459 Nc1ccccc1
72.	1.299055459 Cc1ccccc1
73.	0.888955593 Cc1ccccc1
74.	0.893914729 Nc1ccccc1
75.	0.796447375 Nc1ccccc1
76.	1.465993002 Nc1ccccc1
77.	1.299055459 Cc1ccccc1
78.	1.374154982 Cc1ccccc1
79.	0.857042119 Cc1ccccc1
80.	1.299055459 Cc1ccccc1
81.	1.173722957 Cc1ccccc1
82.	1.299055459 Cc1ccccc1
83.	1.196653987 Nc1ccccc1
84.	1.042539015 Cc1ccccc1
85.	1.383053623 Cc1ccccc1
86.	1.799055974 Cc1ccccc1
87.	1.799055974 Cc1ccccc1
88.	2.562425837 NNc6(=O)[O]c1ccccc1
89.	1.116521976 Cc1ccccc1
90.	1.799055974 Cc1ccccc1
91.	1.383827165 Cc1ccccc1
92.	1.299055459 Cc1ccccc1
93.	1.299055459 Cc1ccccc1
94.	1.334967874 Cc1ccccc1
95.	1.092539249 Cc1ccccc1
96.	1.276795207 Cc1ccccc1
97.	0.705042367 Nc1ccccc1
98.	1.299055459 Cc1ccccc1
99.	1.299055459 Cc1ccccc1
100.	1.299055459 Cc1ccccc1
101.	0.905166117 Cc1ccccc1
102.	1.699328541 Cc1ccccc1
103.	1.299055459 Cc1ccccc1
104.	1.334967874 Cc1ccccc1
105.	0.951827043 Cc1ccccc1
106.	1.299055459 Cc1ccccc1
107.	0.95441098 Cc1ccccc1
108.	1.299055459 CC~C1C2C3C4C5C6C7C8C9C10C9C8C7C6C5C4C3C2C1C
109.	1.359105036 Nc1ccccc1
110.	1.438119329 Cc1ccccc1
111.	1.359105036 Cc1ccccc1
112.	0.980854686 Cc1ccccc1
113.	1.029104949 Cc1ccccc1
114.	1.061095104 Cc1ccccc1
115.	1.299055459 Cc1ccccc1
116.	1.299055459 Cc1ccccc1
117.	1.468997813 Nc1ccccc1
118.	10.74418843 O~C1ccccc1
119.	1.299055459 Cc1ccccc1
120.	1.020982832 C1=Oc1ccccc1
121.	4.739411103 Nc1ccccc1
122.	1.299055459 Nc1ccccc1
123.	1.297433297 Cc1ccccc1
124.	0.988955593 Cc1ccccc1
125.	0.979479308 C1=CC(C)C1
126.	1.213882167 Cc1ccccc1
127.	1.383053623 Cc1ccccc1
128.	0.912624446 Cc1ccccc1
129.	1.299055459 Cc1ccccc1
130.	1.299055459 Cc1ccccc1
131.	1.299055459 Cc1ccccc1
132.	1.299055459 Cc1ccccc1
133.	1.181697207 Cc1ccccc1
134.	1.299055459 Cc1ccccc1
135.	0.970451894 Cc1ccccc1
136.	1.299055459 Cc1ccccc1
137.	1.061095104 Cc1ccccc1
138.	1.299055459 Cc1ccccc1
139.	1.468997813 Nc1ccccc1
140.	1.299055459 Cc1ccccc1
141.	1.467855833 Cc1ccccc1
142.	1.299055459 Cc1ccccc1
143.	0.942753372 Cc1ccccc1
144.	1.058823239 Cc1ccccc1
145.	1.299055459 Cc1ccccc1
146.	1.087162625 Cc1ccccc1
147.	1.087162625 Cc1ccccc1
148.	1.299055459 Cc1ccccc1
149.	1.137370581 O~C1ccccc1
150.	0.937451063 Cc1ccccc1
151.	0.824653307 Cc1ccccc1
152.	1.162741671 Cc1ccccc1
153.	1.299055459 Cc1ccccc1
154.	1.00100081 Cc1ccccc1
155.	0.988955593 Cc1ccccc1
156.	1.314292404 Cc1ccccc1
157.	1.299055459 Cc1ccccc1
158.	1.299055459 Cc1ccccc1
159.	1.151902846 Cc1ccccc1
160.	1.103349723 Cc1ccccc1
161.	1.299055459 Cc1ccccc1
162.	1.878139566 Cc1ccccc1
163.	1.043865477 Cc1ccccc1
164.	1.070210954 O~C1ccccc1
165.	1.299055459 Cc1ccccc1
166.	1.468995008 Cc1ccccc1
167.	1.468995008 Cc1ccccc1
168.	1.468995008 Cc1ccccc1
169.	1.299055459 Cc1ccccc1
170.	1.346967104 Cc1ccccc1
171.	0.988955593 Cc1ccccc1
172.	1.140770057 Cc1ccccc1
173.	1.086978756 Cc1ccccc1
174.	1.299055459 Cc1ccccc1
175.	4.748249663 Cc1ccccc1
176.	1.092687452 Cc1ccccc1
177.	1.193077133 Cc1ccccc1
178.	1.772023605 Cc1ccccc1
179.	1.299055459 Cc1ccccc1
180.	1.003730074 O~C1ccccc1
181.	1.775748111 Nc1=CC2=C(c1ccccc1)-C(=O)c1ccccc1
182.	0.988955593 Cc1ccccc1
183.	0.988955593 Cc1ccccc1
184.	1.409590212 Cc1ccccc1
185.	1.299055459 Cc1ccccc1
186.	1.014127205 Cc1ccccc1
187.	1.299055459 Cc1ccccc1
188.	0.872056485 N#Cc1ccccc1
189.	0.872056485 Cc1ccccc1
190.	1.299055459 Cc1ccccc1
191.	0.8176056598 Bc1ccccc1
192.	0.988955593 Cc1ccccc1
193.	1.002074343 Cc1ccccc1
194.	1.409590212 Cc1ccccc1
195.	1.299055459 Cc1ccccc1
196.	1.102820213 Cc1ccccc1
197.	1.468997813 Cc1ccccc1
198.	0.775779316 Nc1=CC2=C(c1ccccc1)-C(=O)c1ccccc1
199.	0.988955593 Cc1ccccc1
200.	1.750060628 Cc1ccccc1