

연 구 노 트

The Laboratory Research Notebook

연구노트의 바람직한 작성방식

연구노트의 사용자

- 참여연구자는 각각 별도의 연구노트를 작성하는 것이 바람직하다.

연구노트 내용

- 연구노트는 기재내용의 위조·변조 없이 객관적인 사실만을 상세하고 정확하게 기록하여야 한다.
- 발명의 착상, 착상의 실행을 위한 연구계획부터 과정, 결과까지 순차적으로 연구 상황을 기록한다.
- 연구수행 과정 및 결과는 제3자가 재현 가능하도록 작성하여야 한다.

연구 데이터의 관리

- 연구노트에 보관이 힘든 자료(컴퓨터 파일로 작성된 다량의 결과물, 변질되기 쉬운 필름 등의 원본데이터)는 별도 보관 후 상호인용(Cross-reference) 한다.

연구노트 조작 가능성 배제

- 원문기입, 스케치 및 도표는 지워지거나 나중에 기입될 가능성을 배제하기 위하여 지워지지 않는 필기구로 기록한다.
- 연구노트에 직접 기입될 수 없는 것(예 : 사진, 실험기계의 출력물 등)은 일자순으로 풀 등으로 부착시킨다.
- 잘못된 부분을 지울 때는 수정액 등으로 지우지 말고 볼펜 등으로 줄을 그어 수정하고, 중요한 수 정인 경우 오기를 설명하는 주석에 일자를 기재하고 증인과 함께 서명한다.
- 추가로 기입될 가능성을 배제하기 위하여 항목 사이의 공백에 커다랗게 사선을 긋는다.
- 연구노트는 한 페이지라도 없어져서는 안된다.

연구노트의 서명

- 기재한 모든 기록과 수정한 부분에 기록자와 점검자의 서명을 해야 한다.
- 점검자는 발명자 또는 기록자가 아니면서 발명에 대해 어느 정도의 지식을 가진 자가 적당하며, 점검자(증인)의 공정성을 보여주기 위해서 같은 연구 프로젝트 수행자보다 다른 연구팀의 구성원이 바람직하다.

| 연구노트 체크리스트 |

No.	항 목	예	아니오
1	노트 앞면에 노트번호와 기록자 성명이 기재되어 있는가?	<input type="checkbox"/>	<input type="checkbox"/>
2	모든 페이지에 일련번호가 매겨진 묶음형식의 노트에 기록 되었는가?	<input type="checkbox"/>	<input type="checkbox"/>
3	작성된 내용은 지워지지 않는 필기구로 기록되었는가?	<input type="checkbox"/>	<input type="checkbox"/>
4	건너뛴 페이지는 없는가?	<input type="checkbox"/>	<input type="checkbox"/>
5	완료된 페이지에는 공란이 없는가?	<input type="checkbox"/>	<input type="checkbox"/>
6	각 기록들은 연속적으로 작성되었는가?	<input type="checkbox"/>	<input type="checkbox"/>
7	모든 페이지에 기록자의 서명이 되어있는가?	<input type="checkbox"/>	<input type="checkbox"/>
8	수정된 부분은 수정 전의 내용을 확인 가능하고, 수정된 날짜와 기록자의 서명이 되어있는가?	<input type="checkbox"/>	<input type="checkbox"/>
9	정보의 기록이 읽기 쉽고, 시간 순서적이고, 완전한가?	<input type="checkbox"/>	<input type="checkbox"/>
10	후일에 만들어진 기록은 분리된 페이지에 기록되고 이전 기록을 포함한 관련 페이지와 상호 참조되었는가?	<input type="checkbox"/>	<input type="checkbox"/>
11	부수적인 자료는 연구노트에 고정되고, 부착된 날짜와 기록자의 서명이 되어있는가?	<input type="checkbox"/>	<input type="checkbox"/>
12	연구노트에 첨부할 수 없는 데이터의 경우 따로 보관하고 관리하였는가?	<input type="checkbox"/>	<input type="checkbox"/>
13	모든 기록이 공정하고 신뢰할 수 있는 서명자에 의해 통상적인 원칙으로 증명되었는가?	<input type="checkbox"/>	<input type="checkbox"/>
14	연구실의 연구노트들이 적절하게 보관되고 그것들의 위치가 표시되었는가?	<input type="checkbox"/>	<input type="checkbox"/>
15	연구노트는 연구자가 연구의 합법성을 증명하고 싶어하는 만큼 오랫동안 보관 되어지는가?	<input type="checkbox"/>	<input type="checkbox"/>

프로젝트 개요

Summary of Project

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| 키 워 드 |

| 목 적 |

| 연구 내용 요약 |

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원소주기율표

주기 \ 족	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1 H																	2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba	* 71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra	* 103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Uub	113 Uut	114 Uuq	115 Uup	116 Uuh	117 Uus	118 Uuo
*란타넘족 Lanthanoids			* 57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb		
*악티늄족 Actinoids			* 89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No		

주요 원소기호 · 분자기호

번호	원소기호	원소이름	번호	원소기호	원소이름	번호	분자기호	분자이름	번호	분자기호	분자이름
1	H	수소	26	Cu	구리	51	O ₃	오존	76	K ₂ CO ₃	탄산칼륨
2	He	헬륨	27	Zn	아연	52	O ₂	산소	77	Ca(NO ₃) ₂	질산칼슘
3	Li	리튬	28	Ge	게르마늄	53	CO	일산화탄소	78	KNO ₃	질산칼륨
4	Be	베릴륨	29	Br	브롬	54	CO ₂	이산화탄소	79	AgOH	질산은
5	B	붕소	30	Rb	루비듐	55	NH ₃	암모니아	80	AgCl	염화은
6	C	탄소	31	Sr	스트론튬	56	HCl	염화수소	81	CH ₃ COOH	아세트산
7	N	질소	32	Ag	은	57	N ₂	질소	82	NaNO ₃	질산나트륨
8	O	산소	33	Cd	카드뮴	58	HBr	브롬화수소	83	NaCl	염화나트륨
9	F	플루오르	34	Sn	주석	59	H ₂ O	물	84	Na ₂ SO ₄	황산나트륨
10	Ne	네온	35	Au	금	60	H ₂ O ₂	과산화수소	85	K ₂ SO ₄	황산칼륨
11	Na	나트륨	36	Pt	백금	61	SO ₂	이산화황	86	KI	요오드화칼륨
12	Mg	마그네슘	37	U	우라늄	62	NO ₂	이산화질소	87	Fe ₃ O ₄	요오드화철
13	Al	알루미늄	38	Pb	납	63	CH ₄	메탄	88	CaSO ₄	황산칼슘
14	Si	규소	39	I	요오드	64	CH ₃ OH	메탄올	89	K ₂ SO ₄	황산칼륨
15	P	인	40	Cs	세슘	65	C ₂ H ₅ OH	에탄올	90	FeO	산화철
16	S	황	41	Hg	수은	66	FeS	황화철	91	SnCl ₂	염화주석
17	Cl	염소	42	Ce	세륨	67	PbS	황화납	92	CuCl	염화구리
18	Ar	아르곤	43	Ga	갈륨	68	MgO	산화마그네슘	93	Cu(NO ₃) ₂	질산구리
19	K	칼륨	44	Cm	퀴륨	69	NaCl	염화나트륨	94	CuSO ₄	황산구리
20	Ca	칼슘	45	Ho	홀름	70	MgCl ₂	염화마그네슘	95	AlCl ₃	염화알루미늄
21	Cr	크롬	46	Lu	루테튬	71	Cu ₂ SO ₄	황산구리	96	H ₂ S	황화수소
22	Mn	망간	47	Y	이트륨	72	ZnCl ₂	염화아연	97	CuO	산화구리
23	Fe	철	48	Nb	니오브	73	CaCl ₂	염화칼슘	98	HCl	염화수소
24	Co	코발트	49	Ti	티탄	74	KCl	염화칼륨			
25	Ni	니켈	50	Sc	스칸듐	75	CaCO ₃	탄산칼륨			

단위환산표

길 이

단위	mm	cm	m	km	in	feet	yard	mile
mm	1	0.1	0.001	—	0.03937	—	—	—
cm	10	1	0.01	—	0.393701	0.032808	—	—
m	1000	100	1	0.001	39.3701	3.28084	1.09361	—
km	—	—	1000	1	—	3280.84	1093.61	0.621371
in	25.4	2.54	—	—	1	0.083333	0.027778	—
feet	304.8	30.48	0.3048	—	12	1	0.33333	—
yard	914.4	91.44	0.9144	0.000914	36	3	1	0.000568
mile	—	—	1609.344	1.609344	—	5280	1760	1

면적

단위	cm ²	m ²	km ²	in ²	ft ²	yd ²	acre	mile ²
cm ²	1	0.0001	—	0.155	0.001076	0.00012	—	—
m ²	10000	1	0.000001	1550	10.7639	1.19599	0.000247	—
km ²	—	1000000	1	—	—	—	247.105	0.386102
in ²	6.4516	0.000645	—	1	0.006944	0.000772	—	—
ft ²	929.03	0.092903	—	144	1	0.111111	0.000023	—
yd ²	8361.27	0.836127	—	1296	9	1	0.000207	—
acre	—	4046.86	0.004047	—	43560	4840	1	0.001562
mile ²	—	—	2.589987	—	—	—	640	1

중 량

단위	kg	ton	lb	UK cwt	UK ton	US cwt	US ton
kg	1	0.001	2,20462	0.019684	0.000984	0.022046	0.001102
ton	1000	1	2204.62	19.6841	0.984207	22.0462	1.10231
lb	0.453592	0.000454	1	0.008929	0.000446	0.01	0.0005
UK cwt	50.8023	0.050802	112	1	0.05	1.12	0.056
UK ton	1016.05	1.01605	2240	20	1	2204	1.12
US cwt	45.3592	0.045359	100	0.892857	0.044643	1	
US ton	907.185	0.907185	2000	17.8571	0.892857	20	1

면 적

단위	cm ²	m ²	ltrs(dm ³)	in ³	ft ³	yd ³	UK pint	UK gall	US pint	US gall
cm ²	1	—	0.001	0.061024	0.0000353	—	0.00176	0.00022	0.002113	0.000264
m ²	—	1	1000	61023.7	35,3147	1.30795	1759.75	219,969	2113.38	264.172
ltrs(dm ³)	1000	0.001	1	61.0237	0.035315	0.001308	1.75975	0.219969	2.11338	0.264172
in ³	16.3871	0.000016	0.016387	1	0.000579	0.0000214	0.028837	0.003605	0.034632	0.004172
ft ³	28316.8	0.028317	28.3168	1728	1	0.037037	49.8307	6.22883	59.8442	7.48052
yd ³	764555	0.764555	764.555	46656	27	1	1345.429	168.1784	1615.793	201.974
UK pint	568.261	0.0005683	0.568261	34.6774	0.020068	0.000743	1	0.125	1.20095	0.150119
UK gall	4546.09	0.0045461	4.54609	277.42	0.160544	0.005946	8	1	9.6076	1.20095
US pint	473.176	0.0004732	0.473176	28.875	0.01671	0.000619	0.832674	0.104084	1	0.125
US gall	3785.41	0.0037854	3.785411	231	0.133681	0.004951	6.661392	0.832674	8	1

부피/용량

단위	cm ³	m ³	ltrs(dm ³)	in ³	ft ³	yd ³	UK pint	UK gall	US pint	US gall
cm ³	1	—	0.001	0.061024	0.0000353	—	0.00176	0.00022	0.002113	0.000264
m ³	—	1	1000	61023.7	35,3147	1.30795	1759.75	219,969	2113.38	264.172
ltrs(dm ³)	1000	0.001	1	61.0237	0.035315	0.001308	1.75975	0.219969	2.11338	0.264172
in ³	16.3871	0.000016	0.016387	1	0.000579	0.0000214	0.028837	0.003605	0.034632	0.004172
ft ³	28316.8	0.028317	28.3168	1728	1	0.037037	49.8307	6.22883	59.8442	7.48052
yd ³	764555	0.764555	764.555	46656	27	1	1345.429	168.1784	1615.793	201.974
UK pint	568.261	0.0005683	0.568261	34.6774	0.020068	0.000743	1	0.125	1.20095	0.150119
UK gall	4546.09	0.0045461	4.54609	277.42	0.160544	0.005946	8	1	9.6076	1.20095
US pint	473.176	0.0004732	0.473176	28.875	0.01671	0.000619	0.832674	0.104084	1	0.125
US gall	3785.41	0.0037854	3.785411	231	0.133681	0.004951	6.661392	0.832674	8	1

부피/유속

단위	ltrs/sec	ltrs/h	m ³ /sec	m ³ /h	cfm	ft ³ /h	UK gall/m	UK gall/h	US gall/m	US gal/h
ltrs/sec	1	3600	0.001	3.6	2.118882	127.133	13.19814	791.8884	15.85032	951.019
ltrs/h	0.000278	1	—	0.001	0.00588	0.035315	0.003666	0.219969	0.004403	0.264172
m ³ /sec	1000	3600000	1	3600	2118.88	127133	13198.1	791889	1585	0.3951019
m ³ /h	0.277778	1000	0.000278	1	0.588578	35.3147	3.66615	219.969	4.402863	264.1718
cfm	0.471947	1699.017	0.000472	1.699017	1	60	6.228833	373.73	7.480517	448.831
ft ³ /h	0.007866	28.3168	—	0.028317	0.016667	1	0.103814	6.228833	0.124675	7.480517
UK gall/m	0.075768	272.766	0.0000758	0.272766	0.160544	9.63262	1	60	1.20095	72.057
UK gall/h	0.001263	4.54609	—	0.004546	0.002676	0.160544	0.016667	1	0.020016	1.20095
US gall/m	0.06309	227.125	0.0000758	0.227125	0.133681	8.02832	0.832674	49.96045	1	60
US gal/h	0.001052	3.785411	—	0.003785	0.002228	0.133681	0.013878	0.832674	0.016667	1

압 력

단위	atmos	mmHg	bar	pascal	inH ₂ O	inHg	psi	kg/cm ²
atmos	1	760	1.0132	101325	406.781	29.9213	14.6959	1.033
mmHg	0.0013158	1	0.001333	133.322	0.53524	0.03937	0.019337	0.00136
bar	0.9869	750.062	1	100000	401.463	29.53	14.504	1.01957
pascal	0.0000099	0.007501	0.00001	1	0.004015	0.000295	0.000145	0.00001
inH ₂ O	0.0024583	1.86832	0.002491	249.089	1	0.073556	0.036127	0.00254
inHg	0.033421	25.4	0.033864	3386.391	3.5951	1	0.491154	0.003452
psi	0.068046	51.7149	0.068948	6894.76	27.6799	2.03602	1	0.07029
kg/cm ²	0.968	7835.72	0.9808	98088	393.786	28.965	14.226	1

1 kgf/cm² = 10,000 kgf/m² = 10 mH₂O 1 MPa=10⁶ N/m² = 101971.6 kgf/m² = 10.19716 kgf/cm²

열

단위	Btu/h	w	kcal/h	kw
Btu/h	1	0.293017	0.251996	0.000293
w	3.41214	1	0.859845	0.001
kcal/h	3.96832	1.163	1	0.001163
kw	3462.14	1000	589.845	1

에너지

단위	Btu	Therm	J	KJ	cal
Btu	1	0.00001	1055.06	1.055	251.996
Therm	100000	1	—	105.5	25199.60
J	0.00094	—	1	0.001	0.2388
KJ	0.9478	9.478E-06	1000	1	238.85
cal	0.0039683	0.0039683x10 ⁵	4.1868	—	1

비 열

단위	Btu/lb °F	J/kg °C
Btu/lb °F	1	4186.8
J/kg °C	0.00023	1

1kcal/kg °C= 1 Btu/lb °F

열용량

단위	Btu/lb	J/kg
Btu/lb	1	2,326
J/kg	0.4299	1

전열계수

단위	Btu/ft ² h°F	w/m ² °C	kcal/m ² h°C
Btu/ft ² h°F	1	5.67826	4.88243
w/m ² °C	0.17611	1	0.859845
kcal/m ² h°C	0.204816	1.163	1

전열속도

단위	Btu/ft ² h	w/m ²	kcal/m ² h
Btu/ft ² h	1	3.154	2.712
w/m ²	0.3169	1	0.859
kcal/m ² h	0.368	1.163	1

선속도

단위	ft/m	ft/sec	m/sec
ft/m	1	0.016666	0.00508
ft/sec	m/sec 60	1	0.3048
m/sec	196.85	3.28084	1

점도

단위	pa · s	kgf · s/m ²	g/cm · s(p)	kgm · h	lbf · s/ft ²
pa · s	1	0.10197	10	3.6x10 ³	2.089x10 ⁻²
kgf · s/m ²	9.80665	1	98.07	3.53x10 ⁴	0.20481
g/cm · s(p)	0.1	1.020x10 ⁻²	1	360	2.089x10 ⁻³
kgm · h	2.778x10 ⁻⁴	2.833x10 ⁻⁵	2.778x10 ⁻³	1	5.80x10 ⁻⁶
lbf · s/ft ²	47.88		478.8	1.724x10 ⁵	1

에너지

단위	m ² /sec	cm ² /s(st)	m ² /h	ft ² /sec	ft ² /h
m ² /sec	1	1x10 ⁻⁴	3.6x10 ³	10.764	3.875x10 ⁴
cm ² /s(st)	1x10 ⁻⁴	1	0.36	1.0764x10 ⁻³	3.785
m ² /h	2.778x10 ⁻⁴	2.778	1	2.990x10 ⁻³	10.764
ft ² /sec	9.290x10 ⁻²	929	334.4	1	3.6x10 ³
ft ² /h	2.581x10 ⁻⁵	0.2581	9.29x10 ⁻²	2.778x10 ⁻⁴	1

