TABLE 28

R_F VALUES OF SOME ORGANIC ACIDS AND THEIR DERIVATIVES

(H. F. MUELLER, T. E. LARSON AND M. FERRETTI, *Anal. Chem.*, 32 (1960) 687)

Solvents: S_1 = Ethanol–butan-1-ol–conc. NH_4OH (5:45:50).
S_2 = Butan-1-ol–acetic acid–water (4:1:5).
S_3 = Pentan-1-ol–5 *M* formic acid (1:1).
Paper: Whatman No. 1 (ascending).
Detection: 1% ethanolic $FeCl_3$, containing 0.1% HCl (hydroxamates); 0.04% bromophenol blue (in 95% ethanol at pH 6.7); 0.1% neutral ethanolic mercurochrome solution.

Acid	R_F		
	S_1[a]	S_2[b]	S_3[c]
Butyric	0.37	0.78	—
Crotonic	0.31	0.78	—
Propionic	0.28	0.66	—
Acetic	0.16	0.58	—
Pyruvic	—	0.55	0.06, 0.62
Formic	0.14	0.48	—
Alkylbenzenesulphonic (ABS, an anionic detergent)	0.77	—	0.72, 0.04
Lactic	0.14	0.49	0.55
Succinic	—	0.55, 0.52, 0.47[d]	0.60
Gallic	0.09	—	0.48
Malonic	0.02	—	0.50
Oxalic	—	0.59, 0.55[d]	—
Aconitic	—	0.53, 0.66[d]	0.67
l-Malic	—	0.57, 0.52, 0.44, 0.49[d]	0.32
Citric	0.23	0.52	0.23
Isocitric	—	0.59, 0.45[d]	—
Tartaric	—	0.52	0.15

[a] Sodium salt.
[b] Hydroxamate.
[c] Acid.
[d] Hydroxamates not satisfactory. Two or three values for a single acid given in order of intensity.

TABLE 29

R_F VALUES OF SOME GUANIDINE BASES

(J. P. BLASS, *Biochem. J.*, 77 (1960) 484)

Solvents: S_1 = Butan-1-ol–formic acid–water (77:11:12, by vol.).
S_2 = Propan-2-ol–acetic acid–water (15:1:4, by vol.).
Paper: Whatman No. 1 (descending).
Detection: Sakaguchi reagent; pentacyanoferriate reagent (I. SMITH, *Chromatographic Techniques*, William Heinemann Medical Books Ltd., London, 1958, p. 149).

Compound	R_F*	
	S_1	S_2
Arginine	0.07	0.17
γ-Guanidobutyric acid	0.45	0.56
Glycocyamine	0.23	0.38
Taurocyamine	0.11	0.29
Creatine	0.35	0.33

* Figures represent the mean of at least four determinations; S.D. is about 10%.

TABLE 30

R_F VALUES OF SOME PHENOLIC GLYCOSIDES

(J. D. ANDERSON, L. HOUGH AND J. B. PRIDHAM, *Biochem. J.*, 77 (1960) 564)

Solvents: S_1 = Butan-1-ol–pyridine–water (6:4:3, by vol.).
S_2 = Butan-1-ol–ethanol–water (40:11:19, by vol.).
S_3 = Ethyl acetate–acetic acid–water (9:2:2, by vol.).
Paper: Whatman No. 1 (descending).
Detection: Diazotised *p*-nitraniline–Na_2CO_3 (T. SWAIN, *Biochem. J.*, 53 (1953) 200).

Compound	R_F		
	S_1	S_2	S_3
Arbutin	0.75	0.40	0.51
p-Hydroxyphenyl β-gentiobioside	0.55	0.07	0.17
p-Hydroxyphenyl β-cellobioside	0.61	0.10	0.24
Salicin	—	0.56	0.48
o-Hydroxybenzyl β-glucoside	—	0.59	0.48

TABLE 31

ELECTROPHORETIC MOBILITIES OF SOME PHENOLIC GLYCOSIDES

(J. D. ANDERSON, L. HOUGH AND J. B. PRIDHAM, *Biochem. J.*, 77 (1960) 564)

Electrolyte: 0.1 *M* sodium borate buffer (pH 10).
Paper: Whatman No. 3.
Apparatus: J. B. PRIDHAM (*J. Chromatog.*, 2 (1959) 605).
Units: M_{SA}, mobility relative to salicylic acid.
Detection: Diazotised *p*-nitraniline–Na_2CO_3 (T. SWAIN, *Biochem. J.*, 53 (1953) 200).

Compound	M_{SA}
Arbutin	—
p-Hydroxyphenyl β-gentiobioside	0.28
p-Hydroxyphenyl β-cellobioside	0.22
Salicin	0.00
o-Hydroxybenzyl β-glucoside	0.15

TABLE 32

R_F VALUES OF SOME PHENOLIC COMPOUNDS

(W. J. BURKE, A. D. POTTER AND R. M. PARKHURST, *Anal. Chem.*, 32 (1960) 727)

Solvents: S_1 = Butan-1-ol–acetic acid–water (4:1:5).
S_2 = Butan-1-ol–ethanol–formic acid–water (5:1:1:1).
S_3 = 15% aq. acetic acid.
S_4 = Chloroform–propan-2-ol–acetic acid–water (1:2:1:1).
S_5 = Butan-2-ol saturated with water.
Paper: Whatman No. 1 (ascending).
Temperature of run: 26.7° ± 1° (in solvent-saturated atmosphere).
Detection: Neutral silver nitrate (saturated)–acetone reagent (50 ml:1 l; sufficient water to dissolve precipitate), dip or spray.

Compound	$R_F \times 100$					*$AgNO_3$ colour**	*Reaction time*** *(h)*
	S_1	S_2	S_3	S_4	S_5		
Benzoic acids							
3-(OH)	90–95	92–96	68–74	90–94	92–95	lp	1–2
4-(OH)	90–95	88–93	68–77	86–92	92–95	p–t	1–2
2,4-$(OH)_2$	90–95	91–96	61–71	88–94	35–50	p	1–2
3,4-$(OH)_2$	73–81	85–92	64–70	74–80	94–95	db	2–3
2,3,4-$(OH)_3$	75–83	83–89	50–61	65–72	0–45	g	i
3,4,5-$(OH)_3$	61–68	63–70	56–61	55–60	—	b	i
4-(OH)-3-(OCH_3)	87–92	89–94	65–75	93–95	91–95	p–o	1
4-(OCH_3)	89–94	88–95	68–78	92–97	91–95	—	—
3,4-$(OCH_3)_2$	88–94	90–95	73–82	93–96	90–93	—	—
3,4-(OCH_2O)	89–94	91–95	63–73	93–96	91–95	lp	3–4
Cinnamic acids							
3-OH	89–93	90–95	60–70	89–93	94–96	p–t	3–4
4-(OH)	87–92	91–96	56–65	88–94	94–96	p–t	1–3
3-(OH)-4-(OCH_3)	86–91	90–96	46–56	85–90	94–97	lb	1–2
4-(OH)-3-(OCH_3)	86–93	90–95	50–63	91–95	94–97	b	3
3-(OCH_3)	90–94	90–95	64–74	90–97	94–96	—	—
4-(OCH_3)	89–94	89–95	50–63	92–96	94–97	—	—
3,4-$(OCH_3)_2$	90–95	93–96	54–64	95–97	95–97	—	—
3,4-(OCH_2O)	89–94	95–97	44–62	90–95	95–97	p–t	1–3
3,4,5-$(OCH_3)_3$	88–94	89–94	69–78	94–97	92–95	—	—
Phenols							
2-(OH)	88–92	90–95	75–83	88–94	94–97	gr	12–24
3-(OH)	90–94	89–93	73–79	90–94	95–97	b	2–3
4-(OH)	88–93	87–93	77–83	85–88	95–96	g–gr	1–2
2,3-$(OH)_2$	70–80	80–95	68–74	70–76	90–94	g	i
3,5-$(OH)_2$	72–83	73–77	64–71	61–66	89–94	r–b	1–3
2-(OH)-3-(OCH_3)	83–88	84–90	70–77	89–93	95–97	g	1–2
2,6-$(OCH_3)_2$	89–94	—	77–83	94–97	95–97	lb	1–2
Miscellaneous							
Rufigallic acid	0	0	0	0	0–05	t	i
Hexahydroxydiphenyl	47–57	45–55	47–54	38–47	0–40	r–b	i
Hexahydroxybenzophenone	70–75	65–77	31–36	47–53	—	y–b	0–1
m-Digallic acid	58–64	65–73	51–57	51–57	0–25	lt	0–2
Flavellagic acid	0	15–30	—	0–20	0–06	b	i
Ellagic acid	23–35	30–48	0–08	0–35	0–13	lt	0–1
Galloflavin	33–41	25–40	02–22	26–36	0–15	br–b	i
Isogalloflavin	—	27–45	0–23	27–34	0–07	b	i
β-Methyltropolone	90–96	78–95	81–97	93–97	94–96	lg	1–2
Purpurogallin	80–87	80–90	0–31	75–82	0–50	p–b	i
Purpurogallin-carboxylic acid	62–71	64–75	—	47–62	0–08	lt	2–3

* l = light; p = pink; t = tan; d = dark; b = brown; g = grey; o = orange; gr = green; r = red; br = brick.
** i = immediate.

TABLE 33

R_F VALUES OF SOME PHENOLS AND RELATED COMPOUNDS

(I. A. PEARL AND P. F. MCCOY, *Anal. Chem.*, 32 (1960) 1407)

Solvents: S_1 = Butanol saturated with 2 % aqueous NH_4OH at 20°.
S_2 = Butanol–pyridine–water (10:3:3) at 20°.
Paper: Whatman No. 1 (descending).
Temperature of run: 20°.
Detection: D_1 = Fast Scarlet GB salt; Naphthanil Diazo Scarlet 2G (2,5-dichloroaniline).
D_2 = Fast Orange GG salt (*m*-dichloroaniline).
D_3 = Fast Blue VB salt (4-amino-4′-methoxy-diphenylamine).
D_4 = Fast Bordeaux GP Salt (2-amino-3-nitroanisole).
D_5 = Fast Black Salt K (4-amino-2,5-dimethoxy-4′-nitroazobenzene).
D_6 = Fast Bordeaux Salt BD (4-amino-2,5-dimethoxybenzonitrile).
D_7 = Fast Corinth Salt V (4-amino-2,4′-dimethyl-5-methoxy-2′-nitroazobenzene).
D_8 = Fast Red Salt GG (*p*-nitroaniline).
D_9 = Fast Red Salt RL (2-amino-3-nitrotoluene).
D_{10} = Fast Yellow Salt GC (*o*-chloroaniline).

(Note: These are commercial names of the stabilized diazo salt of the compound in parentheses). The solvent is allowed to evaporate, the spot exposed to NH_3 fumes and sprayed immediately with 0.05 % aqueous diazo salt. The paper is then air dried, the colour noted, then sprayed with saturated aqueous Na_2CO_3 after 30 min and the colour again noted.

Compound	R_F		*Colour**									
	S_1	S_2	D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9	D_{10}
Acetosyringone	0.38	0.76	y–bn	y–bn	y–bn	y–bn	bn	y–bn	bn	y–bn	bn–gd	y–bn
Acetovanillone	0.60	0.83	p	s	p	p	v	l–ph	pu	pu	pu	o
Caffeic acid	0.03	0.34	bn	bn–gn	bn	d–gn	g–bn	bn–gn	bn	d–bn	bn	b
p-Coumaric acid	0.18	0.57	v	c	pu	bn–re	v	v	p	b–g	bn–pu	p

2,5-Dihydroxyacetophenone	0.05	0.91	y–gn	y–gn	y–gn	y–gn	y–bn	d–gn	y–bn	y–gn	y–gn	d–gn
2,5-Dihydroxybenzoic acid	0.13	0.30	g–gn	bn	y–bn	g–gn	bn–gd	d–gn	y–bn	bn	bn	g–bn
3,5-Dihydroxybenzoic acid	0.06	0.44	gd	y	pu	d–o	b–v	o	pu	o	o	gd
Ferulic acid	0.13	0.48	pu	p	v	p	g–pu	b	b–g	g–gn	bn	pu
p-Hydroxybenzaldehyde	0.77	0.85	o	y–gd	o	l–t	bn	c	bn	re	bn–re	ph
p-Hydroxybenzoic acid	0.10	0.56	o	gd	o	o	v	c	bn–o	re	pu	gd
2-Hydroxy-5-methoxybenzoic acid	0.38	0.47	pu	re	l–bn	v	w**	bn–p	bn	w	bn–r	s
p-Hydroxyphenyl-acetic acid	0.09	0.62	r–o	c	p	re	bn	pu	b–g	v	pu	s
Protocatechuic acid	0.07	streak	bn	bn	l–bn	gn	bn	bn–gn	bn	bn–pu	bn–pu	bn
Quinic acid	0.01	0.05	—	—	—	—	—	—	—	—	—	—
Salicyl alcohol	0.84	0.86	p	gd	pu	y–o	b	v	b–v	o	pu	gd
Syringaldehyde	0.37	0.74	w	c	p	l–y	bn–oe	pu	bn–gn	b	y	g–gn
Syringic acid	0.05	0.31	c	o	pu	pu	b	v	b	b	v	s
Vanillic acid	0.10	0.41	o	o	r–bn	bn–o	g–b	v	b–v	v	pu	o
Vanillil	0.19	0.87	y–bn	y–gd	y–gd	y–gd	gd	bn–gd	y–bn	bn–gd	y	y
Vanillin	0.44	0.87	c	bn	p	p	g–b	v	b–v	v	pu	o

* After satd. aqueous Na_2CO_3; b = blue; bn = brown; c = coral; d = dark; g = grey; gd = gold; gn = green; l = light; o = orange; oe = olive; p = pink; ph = peach; pu = purple; r = red; re = rose; s = salmon; t = tan; v = violet; w = white; y = yellow.

** Colour due to sizing and resultant spray rejection.

TABLE 34

R_F VALUES OF SOME HALOGENATED PHENOLS

(H. S. CHOGUILL AND D. E. BISSING, *Anal. Chem.*, 32 (1960) 440)

Solvents: S_1 = Benzene–acetic acid–water (2:2:1, by vol.).
S_2 = Hydrochloric acid (20%, w/v).
Paper: Whatman No. 1.
Temperature of run: 25°.
Detection: 1% *p*-Nitrobenzenediazonium fluoborate spray followed by 5% KOH in methanol spray (*cf.* J. H. FREEMAN, *Anal. Chem.*, 24 (1952) 958).

Compound	*R_F range*		
	S_1	S_2	*Colour**
o-Chlorophenol	0.67–0.70	0.72–0.83	a
p-Chlorophenol	0.07–0.16	0.70–0.83	a
o-Bromophenol	0.45–0.48	0.87–0.88	b
p-Bromophenol	0.31–0.32	0.80–0.82	b
o-Iodophenol	0.91–0.94	0.88–0.90	b
p-Iodophenol	0.90–0.94	0.54–0.57	b

* a = light red; b = dark red.

TABLE 35

R_F VALUES OF SOME QUINONES AND PHENOLS

(A. T. DIPLOCK, J. GREEN, E. E. EDWIN AND J. BUNYAN, *Biochem. J.*, 76 (1960) 563)

Solvents: S_1 = Cyclohexane–benzene*.
S_2 = Benzene.
Paper: Not given (60 cm wide).
Impregnation: $ZnCO_3$*.
Time of run: S_1, 1 h; S_2, not given.
Detection: U.V. light.

Compound	*R_F*	
	S_1	S_2
α-Tocopherol	0.71	
Ubiquinone 50	0.77	
RC-ubiquinone	0.73	
Ubiquinol 50	0.73	
o-Cresol		0.63
m-Cresol		0.44
p-Cresol		0.44
2-Methoxyphenol		0.26
3-Methoxyphenol		0.33
4-Methoxyphenol		0.33
γ-Tocopherol	0.45	

* J. BOUMAN AND E. C. SLATER, *Biochim. Biophys. Acta*, 26 (1957) 624.

TABLE 36

R_F VALUES OF SOME AMINOPHENOLS AND DERIVATIVES

(D. V. PARKE, *Biochem. J.*, 77 (1960) 493)

Solvents: S_1 = Diisopropyl ether saturated with water (washed with satd. aq. $KMnO_4$, satd. aq. $FeSO_4$, aq. 2 *N* Na_2CO_3, then water; dried over Na_2SO_4; distilled, b.p. 68°).
S_2 = $CHCl_3$-formic acid–methanol–water (1000:4:100:96, by vol.), (L. REIO, *J. Chromatog.*, 1 (1958) 338).
S_3 = Benzene–methyl ethyl ketone–formic acid–water (900:100:2:98, by vol.), (L. REIO, *J. Chromatog.*, 1 (1958) 338).
S_4 = Ethanol–butan-1-ol–aqueous 3 *N* NH_4OH/3 *N* ammonium carbonate buffer (11:40:19, by vol.) (M. E. FEWSTER AND D. A. HALL, *Nature*, 168 (1951) 78).
Paper: Whatman No. 1 (descending).
Time of run: 6 h (S_1, S_3); 8 h (S_2); 16 h (S_4).
Detection: D_1 = Gibb's reagent (ethanolic 2% 2,6-dichloroquinone-chloroimide, then 2 *N* Na_2CO_3).
D_2 = Diazo reagent, acid (1% $NaNO_2$ in 0.5 *N* HCl followed by 1% ethanolic dimethyl-α-naphthylamine).
D_3 = D_2 followed by 2 *N* Na_2CO_3.
D_4 = aq. 0.5% $FeCl_3$ followed by saturated $NaHCO_3$ (pH values in parentheses).
D_5 = aq. 0.2% Brentamine Fast Blue 2B salt followed by aq. 2 *N* NH_4OH.
D_6 = aq. 0.2% Brentamine Fast Garnet GBC salt followed by aq. 2 *N* NH_4OH.
D_7 = 1% naphthoresorcinol in aq. 20% trichloroacetic acid followed by heating (100°, 20–30 min).
D_8 = aq. 0.1% $BaCl_2$ followed by aq. 0.1% rhodizonic acid (sodium salt).

Compound	R_F				*Colour**							
	S_1	S_2	S_3	S_4	D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8
o-Aminophenol	0.79	0.93	0.96	—	bl	y	gn	b	y	y		
m-Aminophenol	0.60	0.81	0.89	—	v	r	y	neg.	o	r		
p-Aminophenol	0.38	0.85	0.98	—	bl-b**	v	gn	neg.	v	v		
3-Aminocatechol	—	0.90	0.96	—	bl			v(7) v(9)	y	y		
4-Aminocatechol	—	0.33	0.46	—	bl			gn(7) v(9)	v	v		
2-Aminoresorcinol	—	0.87	0.87	—	v			pi(7)	r	r		
					v			bu(9)				
4-Aminoresorcinol	—	0.44	0.80	—	v			o(7) v(9)	v	r		
5-Aminoresorcinol	—	0.01	0.02	—	neg.			neg.	v	r		
Aminoquinol	—	—	—	—	neg.			neg.	neg.	neg.		
Aniline-N-glucuronide	—	—	—	0.09		v					bl***	neg.
p-Aminophenyl-glucuronide	—	—	—	0.02		b					b***	neg.
Glucuronic acid	—	—	—	0.02		neg.					bl***	neg.
Phenylsulphamic acid	—	—	—	0.26		v					neg.***	w
Acetanilide	—	—	—	0.83		v					neg.***	neg.
Aniline†	—	—	—	0.87		v					neg.***	neg.

* bl = blue; b = brown; gn = green; r = red; v = violet; y = yellow; o = orange; w = white on red background; pi = pink; bu = buff; neg. = negative.
** Also reported as negative.
*** Detection reagent applied after hydrolysis by spraying with *N* HCl and heating (100° for 10 min).
† Volatile, therefore only amounts of 200 μg or more can be detected.

TABLE 37

R_F VALUES OF *m*-DINITROBENZENE AND ITS METABOLITES

(D. V. PARKE, *Biochem. J.*, 78 (1961) 262)

Solvents: S_1 = Benzene–acetic acid–water (1:1:2, by vol.).
S_2 = Diisopropyl ether saturated with water (D. V. PARKE, *Biochem. J.*, 77 (1960) 493).
Paper: Whatman No. 1 (descending).
Time of run: 6 h (S_1).
Detection: D_1 = 0.1 *N* NaOH.
D_2 = 1% aq. $FeCl_3$.
D_3 = Gibb's reagent (0.2% ethanolic 2,6-dichloroquinone-chloroimide followed by 2 *N* Na_2CO_3).
D_4 = 0.02% ethanolic *p*-dimethylaminocinnamaldehyde containing 10% (v/v) of 2 *N* H_2SO_4.
D_5 = Reducing reagent (D_4 reagent followed by 1.5% (w/v) $Ti_2(SO_4)_3$ in *N* H_2SO_4).

Compound	R_F		*Colour**				
	S_1	S_2	D_1	D_2	D_3	D_4	D_5
m-Dinitrobenzene	0.95	0.93	—	—	—	n	v
m-Nitrosonitrobenzene	0.96	0.93	—	—	—	pv	v
m-Nitrophenylhydroxylamine	0.97	0.92	—	—	—	pv	v
3,3′-Dinitroazoxybenzene	0.97	0.92	—	—	—	n	v
m-Nitroaniline	0.89	0.91	o	—	—	v	v
m-Phenylenediamine	0.05	0.20	—	—	—	v	v
2,4-Dinitrophenol	0.93	0.73	y	n	y	n	v
2,6-Dinitrophenol	0.91	0.71	y	n	y	n	v
3,5-Dinitrophenol	0.58	0.85	y	n	y	n	v
2-Amino-4-nitrophenol	0.08	0.75	o	bn	o	v	v
2-Amino-6-nitrophenol	0.86	0.83	o	bn	v	v	v
3-Amino-5-nitrophenol	0.07	0.74	y	bu	v	v	v
4-Amino-2-nitrophenol	0.56	0.82	r	bn	v	v	v
2,4-Diaminophenol	0.00	0.01	b	r	—	v	v
2,6-Diaminophenol	0.00	0.03	bn	bn	—	v	v
3,5-Diaminophenol	0.00	0.00	bn	bn	—	v	v

* o = orange; y = yellow; r = red; b = blue; bn = brown; bu = buff; n = none; v = violet; p = pale.