

Science Contest Answer Sheet

Conference _____

Grade Level _____

Contestant # _____

Biology

B01 _____

B02 _____

B03 _____

B04 _____

B05 _____

B06 _____

B07 _____

B08 _____

B09 _____

B10 _____

B11 _____

B12 _____

B13 _____

B14 _____

B15 _____

B16 _____

B17 _____

B18 _____

B19 _____

B20 _____

Chemistry

C01 _____

C02 _____

C03 _____

C04 _____

C05 _____

C06 _____

C07 _____

C08 _____

C09 _____

C10 _____

C11 _____

C12 _____

C13 _____

C14 _____

C15 _____

C16 _____

C17 _____

C18 _____

C19 _____

C20 _____

Physics

P01 _____

P02 _____

P03 _____

P04 _____

P05 _____

P06 _____

P07 _____

P08 _____

P09 _____

P10 _____

P11 _____

P12 _____

P13 _____

P14 _____

P15 _____

P16 _____

P17 _____

P18 _____

P19 _____

P20 _____

B Score

C Score

P Score

Grader Initials _____

OVERALL SCORE

Periodic Table of the Elements

1A 1																8A 18	
1 H 1.008											2 He 4.003						
2A 2												3A 13	4A 14	5A 15	6A 16	7A 17	
3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31	3B 3	4B 4	5B 5	6B 6	7B 7	8B 8	8B 9	8B 10	1B 11	2B 12	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.87	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.41	31 Ga 69.72	32 Ge 72.64	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29
55 Cs 132.91	56 Ba 137.33	57 La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.20	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (277)	109 Mt (268)	110 Ds (281)	111 Rg (272)	112 Cn (285)						

58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)

Some Standard Properties of Water

property	symbol	value
density of water	ρ_{water}	1.000 g cm ⁻³
density of ice	ρ_{ice}	0.9167 g cm ⁻³
specific heats		
ice	C_{ice}	2.09 J g ⁻¹ K ⁻¹
water	C_{water}	4.184 J g ⁻¹ K ⁻¹
steam	C_{steam}	2.03 J g ⁻¹ K ⁻¹
heat of fusion	ΔH_{fus} or L_f	334 J g ⁻¹
heat of vaporization	ΔH_{vap} or L_v	2260 J g ⁻¹
index of refraction	n	1.33
autoionization	K_w	1.0×10^{-14}

Pressure
1 atm = 760 torr
= 101325 Pa
= 14.7 psi
1 bar = 10 ⁵ Pa
= 100 kPa

Energy
1 cal = 4.184 J
1 L atm = 101.325 J
1 Cal = 1 kcal
1 hp = 746 W
1 eV = 1.602 × 10 ⁻¹⁹ J

Various Physical Constants

property	symbol	value
universal gas constant	R	8.314 J mol ⁻¹ K ⁻¹
		62.36 L torr mol ⁻¹ K ⁻¹
		0.08206 L atm mol ⁻¹ K ⁻¹
		1.987 cal mol ⁻¹ K ⁻¹
Planck's constant	h	6.626 × 10 ⁻³⁴ J s
		4.136 × 10 ⁻¹⁵ eV s
Planck's reduced constant	$h/2\pi$	1.054 × 10 ⁻³⁴ J s
		6.582 × 10 ⁻¹⁶ eV s
Boltzmann constant	k_B	1.38 × 10 ⁻²³ J K ⁻¹
Stefan-Boltzmann	σ	5.67 × 10 ⁻⁸ W m ⁻² K ⁻⁴
speed of light	c	3.00 × 10 ⁸ m s ⁻¹
speed of sound (at 20°C)	v_{air}	343 m s ⁻¹
acceleration of gravity	g	9.80 m s ⁻²
gravitational constant	G	6.67 × 10 ⁻¹¹ N m ² kg ⁻²
Avogadro's number	N_A	6.022 × 10 ²³ mol ⁻¹
elementary charge	e	1.602 × 10 ⁻¹⁹ C
Faraday	F	96485 C mol ⁻¹
Coulomb's law constant	k	8.988 × 10 ⁹ N m ² C ⁻²
Rydberg constant	R	2.178 × 10 ⁻¹⁸ J

Some Other Conversion Factors

1 in	=	2.54 cm
1 lb	=	453.6 g
1 mi	=	5280 ft = 1.609 km
1 gal	=	4 quarts = 231 in ³ = 3.785 L

property	symbol	value
electron rest mass	m_e	9.11 × 10 ⁻³¹ kg
		0.000549 u
		0.511 MeV c ⁻²
proton mass	m_p	1.6726 × 10 ⁻²⁷ kg
		1.00728 u
		938.3 MeV c ⁻²
neutron mass	m_n	1.6749 × 10 ⁻²⁷ kg
		1.008665 u
		939.6 MeV c ⁻²
atomic mass unit	u	1.6605 × 10 ⁻²⁷ kg
		931.5 MeV c ⁻²
earth mass		5.972 × 10 ²⁴ kg
earth radius		6.371 × 10 ⁶ m
moon mass		7.348 × 10 ²² kg
sun mass		1.989 × 10 ³⁰ kg
distance earth-moon		3.844 × 10 ⁸ m
distance earth-sun		1.496 × 10 ¹¹ m
permittivity of free space	ϵ_0	8.85 × 10 ⁻¹² F m ⁻¹
permeability of free space	μ_0	4π × 10 ⁻⁷ T m A ⁻¹

Some Average Bond Energies (kJ/mol)

C-H	413	C-C	346	C-Cl	339	C-N	305
O-H	463	C=C	602	C-Br	285	N=N	418
N-H	391	C≡C	835	O=O	498	H-H	436
C-O	358	C=O	799	C≡O	1072	Br-Br	193
H-Cl	432	S-H	347	N≡N	945	Cl-Cl	242
H-Br	366	H-I	299	C≡N	887	I-I	151