CSP formula sheet with worked examples

19 formulas for the calculation tasks in BCSP's CSP11 blueprint. Each worked example is computed by code and checked against the source. Checked 2026-10-16.

At the exam, BCSP says: “For any question requiring a mathematical formula, the formula will be included within the exam question (unless the question is specifically testing your knowledge of a formula). You will not be provided or permitted to bring a formula sheet.” (BCSP, What to Expect When Sitting for a BCSP Exam (item 7), https://www.bcsp.org/bcsp-news/about/bcsp-news/what-to-expect-when-sitting-for-a-bcsp-exam)

1. Incidence rate (TRIR)

IR = (N × 200,000) ÷ EH

N = recordable injuries and illnesses; EH = total hours worked by all employees in the year; 200,000 = 100 full-time workers × 40 h × 50 weeks.

Example. BLS example: 7 recordable cases and 400,000 hours worked.
(7 × 200,000) ÷ 400,000 = 3.5

Source: BLS, How To Compute Your Firm's Incidence Rate for Safety Management. https://www.bls.gov/iif/overview/compute-nonfatal-incidence-rates.htm

2. DART rate

DART = (N × 200,000) ÷ EH

N = cases with days away from work, job restriction or transfer (OSHA 300 Log columns H + I); EH = total hours worked.

Example. BLS example: 3 such cases and 400,000 hours worked.
(3 × 200,000) ÷ 400,000 = 1.5

Source: BLS, How To Compute Your Firm's Incidence Rate for Safety Management. https://www.bls.gov/iif/overview/compute-nonfatal-incidence-rates.htm

3. Noise dose

$$D = 100 \times (C1/T1 + C2/T2 + \ldots + Cn/Tn)$$

C = hours at a given sound level; T = OSHA reference duration for that level from Table G-16a (90 dBA = 8 h, 95 dBA = 4 h).

Example. 4 h at 90 dBA and 4 h at 95 dBA.
$100 \times (4/8 + 4/4) = 150\%$

Source: 29 CFR 1910.95, Appendix A. https://www.ecfr.gov/current/title-29/section-1910.95

4. Noise TWA from dose

$$TWA = 16.61 \times \log10(D \div 100) + 90$$

D = dose in percent. A 100% dose is a 90 dBA TWA; a 50% dose is 85 dBA, the hearing conservation action level.

Example. A 150% dose (the example above).
$16.61 \times \log10(1.5) + 90 = 92.9$ dBA
1910.95 Table A-1 lists 92.9 dBA for a 150% dose.

Source: 29 CFR 1910.95, Appendix A. https://www.ecfr.gov/current/title-29/section-1910.95

5. Reference duration for a sound level

$$T = 8 \div 2^{((L - 90) \div 5)}$$

L = A-weighted sound level in dBA. Each 5 dB above 90 halves the allowed time (OSHA's 5-dB exchange rate).

Example. L = 95 dBA.
$8 \div 2^{((95 - 90) \div 5)} = 4.0$ h
Table G-16a lists 4 hours for 95 dBA. eCFR shows this formula as an image under the table.

Source: 29 CFR 1910.95, Appendix A, Table G-16a. https://www.ecfr.gov/current/title-29/section-1910.95

6. 8-hour TWA exposure (air contaminants)

$$E = (Ca \times Ta + Cb \times Tb + \ldots + Cn \times Tn) \div 8$$

C = concentration during a period; T = hours at that concentration. E may not exceed the substance's 8-hour TWA in Subpart Z.

Example. OSHA example: 2 h at 150 ppm, 2 h at 75 ppm, 4 h at 50 ppm; limit 100 ppm.
$(2 \times 150 + 2 \times 75 + 4 \times 50) \div 8 = 81.25$ **ppm, under 100 ppm**

Source: 29 CFR 1910.1000(d)(1)(i). https://www.ecfr.gov/current/title-29/section-1910.1000#p-1910.1000(d)(1)(i)

7. Mixture of air contaminants

$$Em = C1/L1 + C2/L2 + \ldots + Cn/Ln$$
Em must not exceed 1

C = measured concentration of each substance; L = its exposure limit from Subpart Z.

Example. OSHA example: 500 ppm (limit 1,000), 45 ppm (limit 200), 40 ppm (limit 200).
$0.500 + 0.225 + 0.200 = 0.925$, **under 1, so within limits**

Source: 29 CFR 1910.1000(d)(2)(i). https://www.ecfr.gov/current/title-29/section-1910.1000#p-1910.1000(d)(2)(i)

8. NIOSH recommended weight limit (U.S. units)

$$RWL = 51 \times HM \times VM \times DM \times AM \times FM \times CM$$
$$HM = 10/H,\ VM = 1 - 0.0075|V - 30|$$
$$DM = 0.82 + 1.8/D,\ AM = 1 - 0.0032A$$
$$LI = load \div RWL$$

H, V, D in inches; A in degrees; FM and CM from the manual's frequency and coupling tables. LI above 1 means elevated risk.

Example. H = 20 in, V = 15 in, D = 25 in, A = 30°, one lift every 5 min for 8 h (FM 0.85), fair coupling below 30 in (CM 0.95), 30 lb load.
$51 \times 0.50 \times 0.8875 \times 0.892 \times 0.904 \times 0.85 \times 0.95 = 14.7$ **lb; LI =** $30 \div 14.7 = 2.0$

Source: NIOSH, Applications Manual for the Revised NIOSH Lifting Equation (DHHS Pub. No. 94-110). https://stacks.cdc.gov/view/cdc/110725

9. Wet bulb globe temperature (WBGT)

Outdoors: WBGT = 0.7 tnwb + 0.2 tg + 0.1 ta
Indoors: WBGT = 0.7 tnwb + 0.3 tg

tnwb = natural wet bulb; tg = globe; ta = dry bulb (air) temperature, all in the same units.

Example. Outdoors, tnwb 78°F, tg 100°F, ta 88°F.
0.7 × 78 + 0.2 × 100 + 0.1 × 88 = 83.4°F
The same readings indoors (no ta term): 0.7 × 78 + 0.3 × 100 = 84.6°F.

Source: NIOSH, Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments (Pub. 2016-106), PDF p. 145. https://www.cdc.gov/niosh/docs/2016-106/pdfs/2016-106.pdf#page=145

10. Dilution ventilation

qd = (387 × lbs) ÷ (MW × min × d)
Qd = (qd × Km × 10^6) ÷ Ca

lbs = pounds evaporated; MW = molecular weight; min = minutes; d = density correction (1 at standard air); Km = mixing factor (2 to 5); Ca = acceptable concentration in ppm (typically half the PEL).

Example. 2 lb of toluene (MW 92.14) evaporates in 60 min, d = 1, Km = 3, Ca = 50 ppm.
qd = 774 ÷ 5,528.4 = 0.140 cfm; Qd = 0.140 × 3 × 10^6 ÷ 50 = 8,400 cfm

Source: OSHA Technical Manual, Section III, Chapter 3 (Ventilation Investigation), General Exhaust (Dilution) Ventilation Systems. https://www.osha.gov/otm/section-3-health-hazards/chapter-3

11. Secondary containment capacity

Capacity ≥ the greater of 10% of total container volume or the largest container

Hazardous waste container storage areas under 40 CFR 264.175. Containers without free liquids are not counted.

Example. 20 drums of 55 gal each.
max(0.10 × 1,100, 55) = 110 gal

Source: 40 CFR 264.175(b)(3). https://www.ecfr.gov/current/title-40/section-264.175#p-264.175(b)(3)

12. Excavation sloping (simple slope, 20 ft or less)

Horizontal run = depth × H:V ratio
Type A 3/4:1, Type B 1:1, Type C 1½:1

Maximum allowable slopes from Subpart P, Appendix B, for excavations 20 ft deep or less.

Example. A 12 ft deep trench in Type C soil.
12 ft × 1.5 = 18 ft of horizontal setback on each side

Source: 29 CFR 1926 Subpart P, Appendix B (Figure B-1). https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1926/subpart-P/appendix-Appendix%20B%20to%20Subpart%20P%20of%20Part%201926

13. Choker hitch capacity by angle of choke

Capacity = choker rating × angle factor
Over 120° 100%, 90–120° 87%, 60–89° 74%, 30–59° 62%, 0–29° 49%

Grade 80 alloy chain choker ratings (OSHA Table 3) apply at angles of choke over 120°.

Example. 1/2 in Grade 80 chain, single-leg choker (9,600 lb), angle of choke 75°.
9,600 lb × 0.74 = 7,104 lb

Source: OSHA, Guidance on Safe Sling Use: Tables and Figures, Table 3 and Fig. 2 (Angle of Choke). https://www.osha.gov/safe-sling-use/tables-figures

14. Personal fall arrest distances

Free fall ≤ 6 ft
Deceleration distance ≤ 3.5 ft

Limits for personal fall arrest systems in construction, 29 CFR 1926.502(d)(16).

Example. The longest fall the two limits allow before the worker stops.
6 ft + 3.5 ft = 9.5 ft

Clearance below must also cover the worker's height below the D-ring, harness stretch and a margin. 1926.502 doesn't set those as numbers; use the equipment maker's figures.

Source: 29 CFR 1926.502(d)(16)(iii)-(iv). https://www.ecfr.gov/current/title-29/section-1926.502#p-1926.502(d)(16)(iii)

15. Radioactive decay

$$A_t = A_0 \times e^{(-\lambda t)}$$
$$\lambda = 0.693 \div T_{1/2}$$

A_0 = starting activity; t = elapsed time; $T_{1/2}$ = half-life, in the same time units as t.

Example. 100 mCi source, half-life 8 days, after 24 days.
$100 \times e^{(-(0.693 \div 8) \times 24)} = 12.5$ mCi
24 days is three half-lives: 100 → 50 → 25 → 12.5.

Source: OSHA, Ionizing Radiation: Introduction to Health Physics handout.
https://www.osha.gov/ionizing-radiation/introduction/handout

16. Inverse square law

$$I_2 = I_1 \times (d_1 \div d_2)^2$$

I = intensity or dose rate at distance d from a point source.

Example. 100 mR/h at 2 ft; what at 6 ft?
$100 \times (2 \div 6)^2 = 11.1$ mR/h

Source: OSHA, Ionizing Radiation: Introduction to Health Physics handout.
https://www.osha.gov/ionizing-radiation/introduction/handout

17. Shielding with half-value layers

$$I = I_0 \times e^{(-\mu x)}$$
$$\mu = 0.693 \div HVL$$

I_0 = unshielded intensity; x = shield thickness; HVL = thickness that halves intensity (same units as x).

Example. 80 mR/h, lead HVL 0.5 in, 1.5 in of lead.
$80 \times e^{(-(0.693 \div 0.5) \times 1.5)} = 10.0$ mR/h
1.5 in is three HVLs: 80 → 40 → 20 → 10.

Source: OSHA, Ionizing Radiation: Introduction to Health Physics handout.
https://www.osha.gov/ionizing-radiation/introduction/handout

18. Mean, median and sample standard deviation

Mean = $\Sigma x \div n$
$s = \sqrt{(\Sigma(x - \text{mean})^2 \div (n - 1))}$

The median is the middle value of the sorted data (the average of the two middle values when n is even).

Example. Data: 2, 4, 4, 4, 5, 5, 7, 9.
mean = 40 ÷ 8 = 5; median = 4.5; s = √(32 ÷ 7) = 2.14

Source: NIST/SEMATECH e-Handbook of Statistical Methods, 1.3.5.1 Measures of Location and 1.3.5.6 Measures of Scale.
https://www.itl.nist.gov/div898/handbook/eda/section3/eda356.htm

19. Fault tree gates (independent events)

OR gate: $P = P(A) + P(B) - P(A)P(B)$
AND gate: $P = P(A) \times P(B)$

P = probability of each independent basic event.

Example. P(A) = 0.1, P(B) = 0.2.
OR: 0.1 + 0.2 − 0.02 = 0.28; AND: 0.1 × 0.2 = 0.02

Source: NUREG-0492, Fault Tree Handbook (U.S. NRC, 1981), Chapter VII.
https://www.nrc.gov/docs/ML1007/ML100780465.pdf

Free 25-question CSP diagnostic with a score for each blueprint domain:
https://passcited.com/diagnostic?exam=CSP

PassCited is not affiliated with or endorsed by the Board of Certified Safety Professionals (BCSP). ASP, CSP and CHST are BCSP marks, used only to name the exams. For study only; confirm values against the cited source.