GPhC calculations formula sheet

Twelve common Part 1 calculation types, each with the formula, a worked example and a check. Original practice examples for revision. Not GPhC questions, and not for patient care. Whether a formula is supplied in the real assessment depends on the question, so read each question for what it gives you.

1. Dose by body weight

```
dose = mg/kg × weight
```

Example: A drug is prescribed at 15 mg/kg per day in 4 equal doses. The patient weighs 72 kg.
Working: 15 × 72 = 1,080 mg per day. 1,080 ÷ 4 = 270 mg per dose.
Check: Check whether the rate is per dose or per day before you multiply.

2. Volume to give

```
volume = dose ÷ strength × volume it is in
```

Example: Give 250 mg. The suspension is 125 mg in 5 mL.
Working: 250 ÷ 125 = 2, and 2 × 5 mL = 10 mL.
Check: Write the strength as mg per mL first (125 ÷ 5 = 25 mg/mL), then 250 ÷ 25 = 10 mL.

3. Percentage w/v

```
1% w/v = 1 g in 100 mL = 10 mg/mL
```

Example: Sodium chloride 0.9% w/v in a 500 mL bag. How much sodium chloride is in the bag?
Working: 0.9% = 0.9 g per 100 mL = 9 mg/mL. 9 × 500 = 4,500 mg = 4.5 g.
Check: Moving between % and mg/mL is a multiply or divide by 10.

4. Dilution

```
C1 × V1 = C2 × V2
```

Example: 5 mL of a 20 mg/mL solution is made up to 50 mL with water. What is the new concentration?
Working: 20 × 5 = C2 × 50, so C2 = 100 ÷ 50 = 2 mg/mL.
Check: The dilution factor is 10 (50 ÷ 5), so the concentration falls ten-fold.

5. Infusion rate (mL/h)

```
rate = volume ÷ time in hours
```

Example: 1,000 mL over 8 hours.
Working: 1,000 ÷ 8 = 125 mL/h.
Check: Convert minutes to hours before dividing.

6. Drip rate

```
drops/min = mL/h × drops per mL ÷ 60
```

Example: 125 mL/h through a giving set of 20 drops/mL.
Working: 125 × 20 = 2,500. 2,500 ÷ 60 = 41.7, so about 42 drops per minute.
Check: Counting drops is whole numbers only, so state how you round.

7. Pump rate from a dose

```
rate (mL/h) = dose per hour ÷ concentration
```

Example: 500 mg in 250 mL (2 mg/mL). Dose required 5 mg/h.
Working: 5 ÷ 2 = 2.5 mL/h.
Check: If the dose is per minute, multiply by 60 first to get per hour.

8. Body surface area (Mosteller)

```
BSA (m²) = √(height in cm × weight in kg ÷ 3,600)
```

Example: Height 170 cm, weight 70 kg, dose 100 mg/m².
Working: 170 × 70 = 11,900. 11,900 ÷ 3,600 = 3.306. √3.306 = 1.818 m². 1.818 × 100 = 181.8, so about 182 mg.
Check: Use the formula the question gives. Some questions provide a BSA or a nomogram value instead. Mosteller is a widely used standard equation; this sheet has checked it against calculator references, not a clinical guideline.

9. Creatinine clearance (Cockcroft-Gault, male)

```
CrCl (mL/min) = (140 − age) × weight × 1.23 ÷ serum creatinine (micromol/L)
```

Example: Man aged 70, 80 kg, serum creatinine 110 micromol/L. For this exercise assume actual body weight is the appropriate weight.
Working: (140 − 70) = 70. 70 × 80 = 5,600. 5,600 × 1.23 = 6,888. 6,888 ÷ 110 = 62.6 mL/min.
Check: The BNF gives the constant as 1.23 for men and 1.04 for women, with serum creatinine in micromol/litre. It says to use ideal body weight where fat is likely to be the major contributor to body mass, so use the weight the question tells you to use.

10. Moles and millimoles

```
mmol = mass in mg ÷ molecular weight (g/mol)
```

Example: How many mmol of sodium chloride (58.5 g/mol) are in 1 g?
Working: 1,000 mg ÷ 58.5 = 17.1 mmol.
Check: For concentration: 0.9% is 9 g/L, and 9 ÷ 58.5 = 0.154 mol/L, which is 154 mmol/L.

11. Displacement volume

```
final volume = diluent added + displacement volume of the powder
```

Example: A 1 g vial has a displacement volume of 0.6 mL. Add 9.4 mL of water for injection.
Working: Final volume = 9.4 + 0.6 = 10 mL. Concentration = 1,000 mg ÷ 10 mL = 100 mg/mL.
Check: If you want a set final volume, diluent to add = final volume − displacement volume. Some sources and questions quote a displacement value instead (the amount of powder that displaces 1 mL), so read which one you are given.

12. Quantity to supply

```
quantity = dose per day × days ÷ unit strength
```

Example: 500 mg four times daily for 7 days using 250 mg capsules.
Working: 500 ÷ 250 = 2 capsules per dose. 2 × 4 × 7 = 56 capsules.
Check: Check for pack sizes, and whether the course is rounded to whole packs.

Before you answer

- Read the whole question and underline what it asks for: dose, volume, rate, quantity or concentration.
- Write down every unit. Convert micrograms, milligrams and grams, and minutes and hours, before you calculate.
- Check whether a rate is per dose, per day, per kg or per m^2.
- Estimate the answer first so a slipped decimal point looks wrong.
- Do the calculation once on paper, then once again by a different route.
- Enter the answer in the units shown beside the answer box, rounded as the question asks.
- Ask whether the answer is clinically sensible for the patient described.

Sources: BNF, prescribing in renal impairment (https://bnf.nice.org.uk/medicines-guidance/prescribing-in-renal-impairment/) for the Cockcroft-Gault constants; The Pharmaceutical Journal, medication maths: displacement volumes and values (https://pharmaceutical-journal.com/article/ld/medication-maths-displacement-volumes-and-values). Online version with the full page: https://www.preregexamprep.com/gphc-calculation-formulas . PreRegExamPrep is not affiliated with or endorsed by the General Pharmaceutical Council.