Using opioids as examples, describe with graphs what is meant by ‘potency’, ‘efficacy’, ‘partial agonist’, ‘competitive antagonist’ and ‘therapeutic index’

**Graded log-dose response curve**

Eg. Response = receptor occupancy

**Full agonist:** Curve (a)
- Achieve maximal response from the receptor
- Eg Morphine is full μ-agonist

**Potency:** ED50 on graph → dose of drug required to produce 50% effect from receptor activation
- mid-point of straight portion of log-dose response curve
- more potent drug (eg sufentanyl) [curve (a)] will have lower ED50 than less potent drug (eg fentanyl) [curve (b)]

**Efficacy:** Effectiveness at which a drug binds to a receptor
- Represented on graph as maximal response (flat upper portion of sigmoid curve)
- Full agonists will have maximal efficacy (response 100%)

**Partial agonist:** Curve (c)
- Drug which has a lower efficacy than a full agonist
- ↓maximal response (less than 100%)
- Eg buprenorphine is a partial agonist of μ-receptor (maximal response less than for morphine)

**Competitive antagonist:** Reversible blockade of the receptor
- Addition of antagonist causes ↑ED50 of full agonist (right shift of curve)
- Effect of antagonist can be overcome by ↑dose of agonist
- Eg naloxone shifts the morphine log_{10} dose-response curve (a) to the right (b)

**Therapeutic Index:** Ratio of LD50 (or TD50):ED50, i.e. ratio b/n effective and lethal (toxic) dose
- lethal/toxic dose for 50% of subjects v effective dose for 50% of subjects
- Enables comparison b/n different drugs
- Provides a measure of margin of safety
- Cannot be determined on a graded log-dose response curve, but needs to be calculated using a quantal curve (needs > 1 subject)