Question 8 (Answer: **C**)

- At P the curve is still rising, so the sphere is still accelerating downwards.
- That needs a downward resultant, so the weight must be larger than the air resistance.
- C is the only diagram with both forces present and the weight arrow the longer one; A is terminal velocity and B the instant of release.

Question 11 (Answer: **A**)

- At t_1 and t_3 she is at terminal velocity, so the drag equals her weight at both – statement 2 holds.
- The graph is steepest just after the parachute opens, so the acceleration peaks at t_2 – statement 1 holds.
- The drag is largest at t_2, not t_1, so statement 3 fails.

2(a)(i)	(normal) force per (unit cross-sectional) area
2(a)(ii)	(due to difference in depth there is a) difference in pressure between top and bottom (of ball)
	(due to pressure difference, upwards) force on bottom of ball is greater (than downwards force on top of ball, so resultant force is upwards)
2(b)(i)	arrow vertically downwards labelled 'weight'
	arrow vertically upwards labelled 'upthrust'
	arrow vertically upwards labelled '(viscous) drag'
2(b)(ii)	SI base units of D: kg m s^{-2}
	base units of η: kg m s^{-2} / (m × m s^{-1}) = kg m^{-1} s^{-1}
2(c)(i)	upthrust = 920 × (4 / 3) × π × (4.2 × 10^{-3})^3 × 9.81 = 2.8 × 10^{-3} (N)
2(c)(ii)	weight = drag + upthrust
	(2.4 × 10^{-3} × 9.81) = (2.8 × 10^{-3}) + (6π × 4.7 × 4.2 × 10^{-3} × v)
	v = 0.056 m s^{-1}

Question 20 (Answer: **B**)

- At terminal velocity the speed is constant, so the parachutist's kinetic energy does not change.
- All the lost gravitational potential energy goes into the air – moving it and warming it.
- B is therefore the statement that is not correct.

Question 12 (Answer: **D**)

- The stone starts with only its weight acting, so the acceleration begins at g.
- As it speeds up the drag grows, so the resultant force – and the acceleration – falls.
- At terminal velocity the acceleration is zero, so the graph starts at g and decays towards zero.

Question 8 (Answer: **B**)

- At terminal velocity the forces on each sphere balance, so each resultant force is zero.
- Zero equals zero, which is precisely why B is the correct statement.
- The denser sphere weighs more, so it needs more drag and falls faster – A, C and D all fail.

Question 8 (Answer: **B**)

- Opening the parachute makes the drag far larger than the weight, so the resultant acts upwards.
- The skydiver therefore slows down.
- As the speed falls the drag falls with it, so the deceleration is not uniform.

3(a)	$W = Fd$
	$P = Fd / t = Fv$ **or** $P = Fvt / t = Fv$
3(b)(i)	$(\Delta)E_{(P)} = mg(\Delta)h$
	increase of gravitational potential energy of car in 1.0 s = 1500 × 9.81 × 30 × sin6.0 = 46 000 J
3(b)(ii)	(Power to overcome total resistive forces) = 1600 × 30 = 48 000 W
	power = 48 000 + 46 000 = 9.4 × 10^4 W
3(c)(i)	Air resistance is the same, as the speed is the same
3(c)(ii)	Mass / weight has increased so (power will) increase