AQA AS Physics exam practice answers

4 Mechanics and materials

**1** tan** = 6/10 = 0.6, so direction = 31° to the bank

speed = √(62 + 102) = 11.7 m s−1

Therefore:

velocity = 11.7 m s−1 at 31° to the bank

**2** resultant force = 300cos35 – 20 = 246 – 20 = 226 N

acceleration = 226/120 = 1.88 m s−2

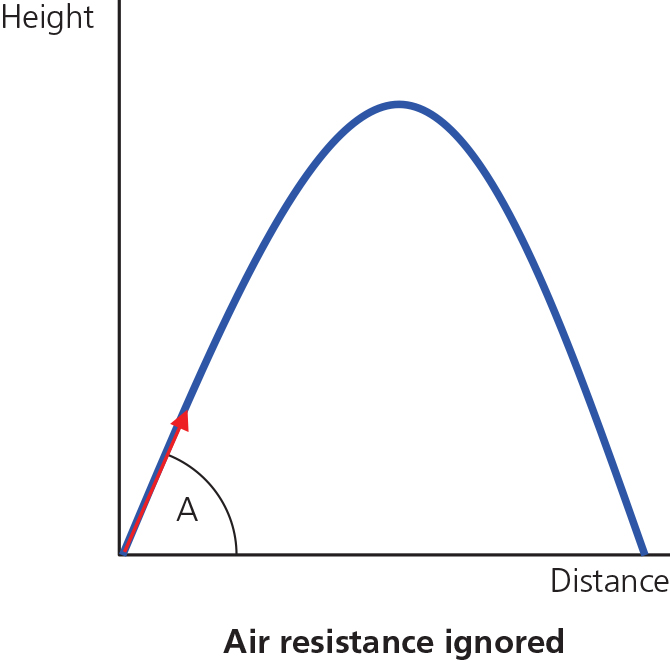
**3 (a)** At maximum height (*H*) vertical velocity = 0

**(b)** velocity = 25cos30 = 21.7 m s−1

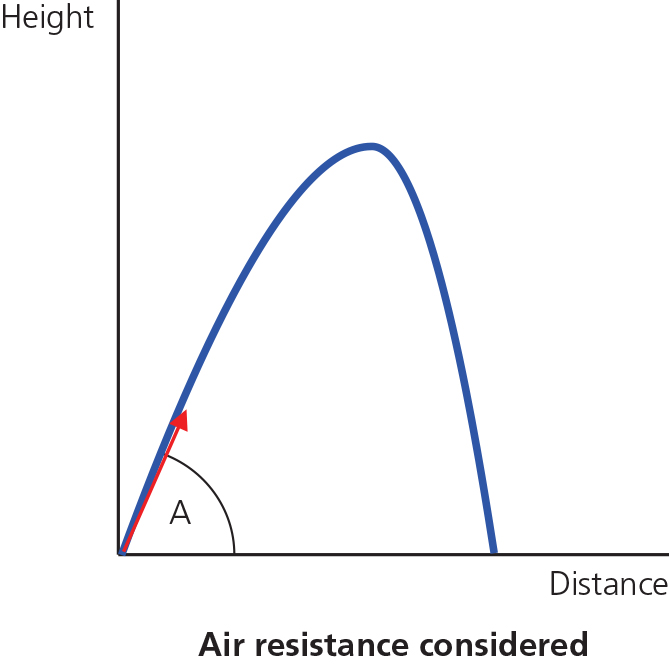
**(c)** velocity = 25cos30 = 21.7 m s−1

**(d)** *H* = *u*2sin2**/2*g* = (625 × sin260)/(2 × 9.8) = 23.92 m

**(e) (i)**



**(ii)**

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**4** C

**5 (a)** 200 × 1.5cos55 = *F* × 3sin55

Therefore:

*F* = 70 N

**(b)** √(702 + 2002) = 212 N, direction tan−1 (200/70) = 71°

**(c)** (200 × 1.5 + 70 × 9.8 × 1)cos55 = 3*F*sin55

Therefore:

*F* = 230 N

**6 (a)** Force = 50 000 – 5000 = 45 000 N

**(b)** acceleration = 45 000/25 000 = 1.8 m s−2

**(c)** net force = accelerated mass × *a* = 8000 × 1.8 = 14 400 N

**(d)** net force of truck 9 on truck 8 = force of truck 8 on truck 9 = accelerated mass × *a* = 4000 × 1.8 = 7200 N

**7** momentum conservation, 5 × 6 = (*m* + 5) × 0.5

mass of boy and skateboard, *m* = (30/0.5) − 5 = 55 kg

**8** A

Set division on 2 lines

**9 (a)** momentum conservation, 0.8 × 25 + *m* × (−75) = 0

*m* = 20/75 = 0.27 kg

**(b)** kinetic energy = ½*mv*2 = 0.5 × 0.8 × 252 = 250 J

**(c)** kinetic energy = ½*mv*2 = 0.5 × 0.27 × 752 = 760 J

**(d)** To conserve momentum.

**10** C

**11** power = *mgh*/(efficiency × *t*) = (50 × 9.8 × 6)/(0.35 × 3) = 2800 W = 2.8 kW

**12 (a)** energy stored = ½*Fe*

*F* = *eAE*/*L* = (4 × 10−2 ×  × (0.375 × 10−3)2 × 6.5 ×109)/1.5 = 76.6 N

energy stored = ½*Fe* = 0.5 × 72.5 × 2 × 10−2 = 0.75 J

**(b)** A sudden jerk attempts to give the line an acceleration, and this must be added to the 'static' tension. It breaks because it has to cope with a rapid acceleration as well as the simple weight of the fish.

**13** B

**14** pressure = *gh* = 2700 × 1.35 × 1012 × *h* = 3.6 × 106

*h* = 9.9 × 10−10 m = 0.99 nm