1. (a) (i) Falls (diving), remains low (submerged), increases (resurfacing);
Any reference to fluctuations / slight rise in pressure after submergence. 2

(ii) Muscle (in wall);
Contraction / narrowing of arteriole reduces (blood flow) / relaxation / dilation
increases (blood flow). 2

(b) (i) 46%; 1

(ii) Respiration Produces carbon dioxide
Increase in carbon dioxide causes decrease in pH; 2

(iii) (Haemoglobin) yields more oxygen;for respiration. 2

(c) Acts as a store of oxygen / obtains oxygen from haemoglobin;
Oxygen released at very low partial pressures of oxygen;
Allows (aerobic) respiration to <u>continue</u> / delays <u>anaerobic</u> respiration. 2

[11]

2. (a) Molecules will have more (kinetic) energy;
Move faster;
Reject references to vibrating in this context 2

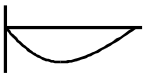
(b) (i) Oxygen diffuses faster/has a higher rate of diffusion
in air than in water; 1

(ii) Alveolar epithelium/surface is permeable to small molecules;
Water is a small molecule;
Higher concentration of water in cell/blood than outside;
Water diffuses from blood/cells into alveoli; max 2

(c) Large number gives large (total) surface area;
For diffusion;
Short distance between tracheoles gives short pathway;
Movement/diffusion through muscle is slow;
Reject references to muscle simply being close to tracheoles. Must convey idea of short pathway to gain credit for third point. 3

[8]

3. (a) One cell thick/thin (not thin membrane)/flattened cells for <u>faster diffusion</u>/shorter diffusion pathway;(Reject greater/more)
Large surface area for <u>faster diffusion</u>;(Reject greater/more)
Ventilation to maintain <u>a diffusion/concentration gradient</u>; 2 max
NB TWO correct features = 1 mark maximum

(b) (i) Decreases first from zero;
Then increases to zero;
'U' shape (not starting at zero) = 1 mark maximum  2

(ii) $\frac{60}{3} = \underline{\underline{20}}$; 1

[5]

4. (a) intercostal muscle; (*internal/external neutral*) 1

(b) (i) contracts;
pulling ribs upwards / outwards; (*ribcage expands neutral*)
(*accept answers in terms of antagonistic role of internal intercostals*);
lung / chest / thorax volume increased, *or* lung / chest / thorax pressure decreased; 3 max

(ii) maintain / greater diffusion / concentration gradient;
continuous diffusion / faster diffusion; 2

[6]

5. (a) contraction of (diaphragm) muscles flattens diaphragm;
contraction of intercostal muscles raises ribcage;
increase in volume decreases pressure; 3

(b) (i) tidal volume increases steeply, then increase slows down after 10 to 15 kmh^{-1}; 1

(ii) breathing rate increases slowly then steeply after 10 to 15 kmh^{-1}; 1
(max 1 if no reference to speed where change occurs in either (i) or (ii))

(c) $20 \times 2.75 = 55\ dm^2$; 2
(award 1 mark for correct method i.e. tidal volume. × rate);

[7]

6. (a) droplets/ref. coughing/sneezing;
which are breathed in/taken in through gas exchange system/nose/lungs;
OR
milk;
drunk/taken into digestive system; 2

(b) 2500×20.066;
$= 50165$; 2

allow 1 mark if correct working shown

[4]