M1. (a)   (i)   vole/small bird/beetle

gains 1 mark

1

   (ii)   oak trees are large organisms;
therefore their biomass is large; but their numbers are small

each for 1 mark

3

(b)   8 of:
energy stored in chemicals in cells/tissues/growth;
passed up food chain;
less energy stored at each stage in food chain/pyramid level;
because only part of energy taken in used for growth;
some lost in waste;
some used for repair;
used to main body systems;
some lost in respiration;
some converted into other forms of energy;
e.g. movement;
much lost as heat;
by time detritus feeders have used remains;
all returned to environment

each for 1 mark

8

c1 → animals
c2 → decomposers

2 marks for sequencing and organising the information

2

[14]

M2. (a) (i) e.g. mussels/caddis loach
for 1 mark

1

(ii) 3 of:
carbon dioxide
water
chlorophyll/chloroplasts
light
any 3 for 1 mark each

3

(b) 6 of e.g.
some plant/animal material not digested by consumers passes out with faeces
respiration releases energy used in movement lost as heat
some 'lower' organisms die energy transferred to decomposers/detritivores
thence to environment
any 6 for 1 mark each

6

[10]

M3. (a)   water

gains 1 mark

oxygen

gains 1 mark

2

(b)   e.g.:
some materials/energy lost in animals' waste materials
respiration releases energy
some materials/energy used in maintenance/repair
some energy used for movement
much lost as heat to surroundings
some organisms die (rather than eaten)
reference to detritivors
reference to microbes

each for 1 mark

8

[10]

M4. (a) $1.67 / 1\frac{2}{3}$

> *accept 1.6 to 1.7*
>
> *ignore working or lack of working* $\frac{400 \times 100}{24000}$ *for **1** mark*

2

(b) any **three** from:

> *deduct only 1 mark for any mention of in carnivore*

lost as heat **or** keeping body warm

> *lost in metabolic functions is not enough*

lost in respiration

> *do **not** accept 'used for respiration*

movement

not eaten parts or individuals / non-edible parts / dead leaves / wood / bones / faeces / urine

> *ignore 'waste'*
>
> *ignore references to growth / reproduction*

3

[5]

M5. (a) (i) 0.6 **or** 6×10^{-1}
    for correct answer

$$\frac{2.4 \times 10^4}{4 \times 10^6} \times 100$$

if no / incorrect answer
or
*0.006 **or** 6×10^{-3} gains **1** mark*

2

(ii) any **two** from:

• reflected
    ignore some of light is green

• not absorbed **or** misses chloroplasts / chlorophyll
    *allow transmitted **or** passes through leaves*
    allow hits other plant parts

• wrong wavelength

• photosynthesis inefficient
    accept other limiting factors / named

• allow some lost through respiration / as heat (from respiration)

2

(b) energy lost via faeces / not digested / waste / excreted (of insect-eating birds)

1

energy loss via respiration / movement / muscle contraction / heat (by insect-eating bird)
    accept examples of muscle contraction
    *do **not** accept energy used for respiration*

1

some of (insect eating) bird not eaten <u>but</u> all / most / more of insect is eaten

1

[7]

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M6.   (a)   16

> *accept correct answer for **2** marks, irrespective of working*
>
> *if no answer **or** answer incorrect accept 0.64 x 100 / 4 (.0) **or** 0.16 for **1** mark*

    2

    (b)   insect cold-blooded / not warm blooded **or** does not control body temperature

> *accept mammal warm-blooded / constant (high) body temperature / controls body temperature*

    1

reference to insect 0.96 (kJ) **and** mammal 12.25 (kJ) transferred by respiration **or** relevant calculation of this transfer

> *ignore references to other data*

    1

(less respiration) so more energy / biomass / food available (for growth of insect)

> *(more respiration) so less energy / biomass / food available (for growth of mammal)*

    1

    [5]

M7. (a)   0.18

> *award both marks for correct answer irrespective of working*
> *if no answer or incorrect answer*
> *allow 1 mark for 45 × 100 / 25000*

2

(b)   heat / thermal

> *allow heat from respiration*

1

(c)   energy / mass / biomass lost / not passed on **or** energy / mass / biomass is used **or** not enough energy / mass / biomass left

> *ignore reference to losses via eg respiration / excretion / movement / heat*

1

a sensible / appropriate use of figures including heron

> *eg only 2 from frog / to heron*
> *ignore units*

1

(d)   any **three** from:

> *accept marking points if candidate uses other terms for microorganisms*

- (microorganisms) decay / decompose / digest / breakdown / rot
  > *ignore eat*

- (breakdown) releases minerals / nutrients / ions / salts / named
  > *ignore food*

- (microorganisms) respiration
  > *ignore other organisms respiring*

- (microorganisms / respiration) release of carbon dioxide

3

[8]