**Mark schemes**

Q1.

(a) It will have a constant speed.

1

(b) distance travelled = speed × time

1

(c) a = 18 − 9

 6

1

a = 1.5

allow 1.5 with no working shown for 2 marks

1

(d) resultant force = mass × acceleration

1

(e) F = (1120+80) × 1.5

1

F = 1800 (N)

allow 1800 with no working shown for 2 marks

1

accept their 10.3 × 1200 correctly calculated for 2 marks

(f) 182 − 92 = 2 × 1.5 × s

1

s = 182 − 92 / 2 × 1.5

1

s = 81 (m)

1

allow 81 (m) with no working shown for 3 marks

accept answer using their 10.3 (if not 1.5) correctly calculated for 3 marks

(g) Level 2 (3–4 marks):

A detailed and coherent explanation is provided. The response makes logical links

between clearly identified, relevant points that include references to the numerical factor.

Level 1 (1–2 marks):

Simple statements are made. The response may fail to make logical links between the points raised.

0 marks:

No relevant content.

Indicative content

• doubling speed increase the kinetic energy

• kinetic energy increases by a factor of 4

• work done (by brakes) to stop the car increases

• work done increases by a factor of 4

• work done is force × distance and braking force is constant

• so if work done increases by 4 then the braking distance must increase by 4

4

[14]

Q2.

(a) distance is a scalar and displacement is a vector

or

distance has magnitude only, displacement has magnitude and direction

1

(b) 37.5 km

accept any value between 37.0 and 38.0 inclusive

1

062° or N62°E

accept 62° to the right of the vertical

1

accept an angle in the range 60° −64°

accept the angle correctly measured and marked on the diagram

(c) train changes direction so velocity changes

1

acceleration is the rate of change of velocity

1

(d) number of squares below line = 17

accept any number between 16 and 18 inclusive

1

each square represents 500 m

1

distance = number of squares × value of each square correctly calculated − 8500 m

1

[8]

Q3.

(a) pitch

1

loudness

1

(b) (i) as length (of prongs) decreases frequency / pitch increases

accept converse

accept negative correlation

ignore inversely proportional

1

(ii) 8.3 (cm)

accept 8.3 ± 0.1 cm

1

(iii) (8.3 cm is) between 7.8 (cm) and 8.7 (cm)

ecf from part (ii)

1

(so f must be) between 384 (Hz) and 480 (Hz)

1

410 (Hz) ≤ f ≤ 450 (Hz)

if only the estimated frequency given, accept for 1 mark an answer within the range

1

(c) (i) electronic

1

(ii) frequency is (very) high

accept frequency above

20 000 (Hz) or audible range

1

so tuning fork or length of prongs would be very small (1.2 mm)

1

(d) 285.7 (Hz)

accept any correct rounding 286, 290, 300

allow 2 marks for 285

allow 2 marks for correct substitution 0.0035 = 1 / f

allow 1 mark for T = 0.0035 s

allow 1 mark for an answer of 2000

3

[13]

Q4.

(a) (i) 20

1

20 000

either order

accept ringed answers in box

1

(ii) (frequency) above human range

accept pitch for frequency

or

(frequency) above 20 000 (Hz)

do not accept outside human range

allow ecf from incorrect value in (a)(i)

1

(iii) any one from:

• pre-natal scanning

accept any other appropriate scanning use

do not accept pregnancy testing

• removal / destruction of kidney / gall stones

• repair of damaged tissue / muscle

accept examples of repair, eg alleviating bruising, repair scar damage, ligament / tendon damage, joint inflammation

accept physiotherapy

accept curing prostate cancer or killing prostate cancer cells

• removing plaque from teeth

cleaning teeth is insufficient

1

(b) 7.5 × 10−4 (m)

1.5 × 103 = 2.0 × 106 × λ gains 1 mark

2

(c) for reflected waves

must be clear whether referring to emitted or detected / reflected waves

if not specified assume it refers to reflected wave

any two from:

• frequency decreased

• wavelength increased

• intensity has decreased

allow amplitude / energy has decreased

allow the beam is weaker

2

[8]

Q5.

(a) gravitational / gravity / weight

do not accept gravitational potential

1

(b) accelerating

accept speed / velocity increases

1

the distance between the drops increases

1

but the time between the drops is the same

accept the time between drops is (always) 5 seconds

accept the drops fall at the same rate

1

(c) (i) any one from:

• speed / velocity

• (condition of) brakes / road surface / tyres

• weather (conditions)

accept specific examples, eg wet / icy roads

accept mass / weight of car friction is insufficient

reference to any factor affecting thinking distance negates this answer

1

(ii) 75 000

allow 1 mark for correct substitution, ie 3000 × 25 provided no subsequent step shown

or allow 1 mark for an answer 75

or allow 2 marks for

75 k(+ incorrect unit), eg 75 kN

2

joules / J

do not accept j

an answer 75 kJ gains 3 marks

for full marks the unit and numerical answer must be consistent

1

[8]

Q6.

(a) (i) 3

1

(ii) 30 000 or 10 000 × their (a)(i) correctly calculated

1

(iii) any two from:

• frequency is above 20 000 (Hz)

accept the frequency is 30 000

• frequency is above the upper limit of audible range

• upper limit of audible range equals 20 000 (Hz)

ignore reference to lower limit

• it is ultrasound/ultrasonic

2

(b) (i) wave (partially) reflected

1

at crack to produce A and end of bolt to produce B

accept at both ends of the crack

1

(ii) 0.075 (m) allow 2 marks for time = 0.0000125

allow 1 mark for time = 0.000025

answers 0.15 or 0.015 or 0.09 gain 2 marks

answers 0.18 or 0.03 gain 1 mark

the unit is not required but if given must be consistent with numerical answer for the available marks

3

[9]

Q7.

(a) (i) same frequency / period / pitch / wavelength

ignore references to amplitude

1

(ii) differences in waveform / shape / quality

accept the diagrams are not identical

1

(b) (i) 20 000 Hz / hertz

 or 20 kHz / kilohertz

in both cases, if the symbol rather than the name is used, it must be correct in every detail

1

(ii) material(s) / substance(s) (through which sound travels)

1

(iii) is absorbed

accept (some) sound (energy) is transformed / transferred as heat / thermal energy

1

 is transmitted

accept is refracted

accept changes speed

accept changes velocity

do not accept is diffracted

do not accept is diffused

do not accept is dissipated

1

[6]

Q8.

(a) (i) Constant speed

2

(ii) Accelerates to higher constant speed

1

(b) (i) Points correct (allow one major or two minor mistakes)

Line correct (for their points)

2

(ii) 5 m/s

or 5

gets 2 marks

or correct unit

gets 1 mark mark

3

(c) (i) 50 s or 50

gets 2 marks

or t = d/v

gets 1 mark

3

(ii) Line correct (of gradient 4 and spans 30 consecutive seconds)

1

(d) (i) 0.04 or 6/15

gets 2 marks

or a = v/t

gets 1 mark

3

[15]

Q9.

(a) any evidence of: momentum = mass × velocity (words, symbols or numbers) appropriate re-arrangement mass as 0.05kg

each gains 1 mark

 but 800

gains 4 marks

4

(b) (i) any reference to friction with air/air resistance

gains 1 mark

 but idea that friction with air/air resistance is high (at high speed)

gains 2 marks

2

(ii) any evidence of: k.e. v2 or k.e. = ½ mv2

final k.e.

initial k.e.

either initial or final k.e. correctly calculated (i.e. 16000; 10240)

each gains 1 mark

 but (0.8)2

gains 3 marks

 but 64%(credit 0.64)

gains 4 marks (also credit e.c.f)

4

[10]