Mark schemes

1. (a) electrostatic 1

gravitational 1

(b) D 1

(c) bring two unlike poles close together

allow north and south poles

allow opposite poles 1

bring two like poles close together

allow two north / south poles

allow N for north and S for south 1

(d) induced magnetism 1

(e) all 4 poles correctly labelled north and south

allow N for north and S for south

allow 1 mark for 2 or 3 correctly labelled poles 2

[8]

2. (a) it is the same size as the downward force 1

(b) weight is a vector 1

(c) centre of mass 1

(d)

*an answer of 441 (N) scores **2** marks*

W = 45 × 9.8 1

W = 441 (N)

allow 440 (N) 1

(e) **Level 2:** Some logically linked reasons are given. There may also be a simple judgement.

3−4

Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.

1−2

No relevant content

0

Indicative content

- as height changes gravitational potential energy changes
- gravitational potential energy decreases when moving to the lower bar
- as speed changes kinetic energy changes
- kinetic energy increases when moving to the lower bar
- transfer from gravitational potential energy to kinetic energy as height decreases
- the sum of the kinetic energy and gravitational potential energy is constant

(f) reduces the force exerted

ignore impact

1

the risk of injury to gymnast is reduced

allow so the gymnast does not get injured

1

[11]

3. (a) there is a resultant force on the ball

1

(b)

*an answer of 2.75 scores **2** marks*

s = 11 × 0.25

1

s = 2.75 (m)

allow 2.8 (m)

1

(c) $\frac{75}{100} \times 30.0$

allow any correct method of determining 75% of 30

1

22.5 (cm)

1

(25.1 > 22.5) therefore the ball can be used

this mark can only be awarded if a supporting calculation has been done

allow any correct supported conclusion

allow a conclusion consistent with an incorrect percentage calculation

OR

$\frac{25.1}{30.0} \times 100$ (1)

84 % (1)

(84% > 75%) therefore the ball can be used (1)

this mark can only be awarded if a supporting calculation has been done

allow any correct supported conclusion

allow a conclusion consistent with an incorrect percentage calculation

1

(d) the smaller ball has a smaller area

1

(so) air resistance is less (on the smaller ball)

1

[8]

4. (a) (thinking distance) will double

1

any correct pair of points from graph eg (200,6) and (400,12)

allow graph shows direct proportionality (after 200 ms)

*allow **1** mark for thinking distance increases with supporting data.*

1

(b) (most) people cannot react any quicker than 200 ms

1

(c) there is variation in the measurements

allow the data is not very precise

allow lots of random error

ignore references to accuracy / reliability / average

1

(d) (258+265+302+248+327) / 5

*an answer of 280 gains **2** marks*

1

280 (ms)

1

(e) 8.4 (m)

allow 7.9 (m) to 8.9 (m)

allow ecf from part (d)

1

(f) any **two** from:

- (material of) road surface
- condition of the tyres
- speed of the car
- wet / icy road surface
- gradient of road
- mass / weight of the car

Ignore any reference to brakes

2

(g) work done = force × distance (along the line of action of the force)

allow W = F s

allow any correct re-arrangement

1

(h)

*an answer of 450 000 scores **3** marks*

F = 6000 N

1

W = 6000 × 75

allow a correct substitution using an incorrectly / not converted value of F

1

W = 450 000 (J)

allow a correct calculation using an incorrectly / not converted value of F

1

[13]

5. (a) velocity

1

frequency

1

wavelength

1

(b) so people are not exposed to (as much) gamma radiation

allow less gamma radiation reaches the Earth's surface

1

because gamma radiation can damage human tissue

allow increases the risk of cancer or (cell) mutation

allow gamma rays are ionising

ignore any reference to temperature / heating of the atmosphere

1

(c) (microwaves) are used in (satellite) communications

ignore any reference to temperature / heating of the atmosphere

1

(d) can cause skin cancer / premature ageing

allow sunburn

allow eye / skin damage

cancer on its own is insufficient

1

(e) risk from UV radiation is highest in July / summer

allow any sensible comparison of named months / seasons

1

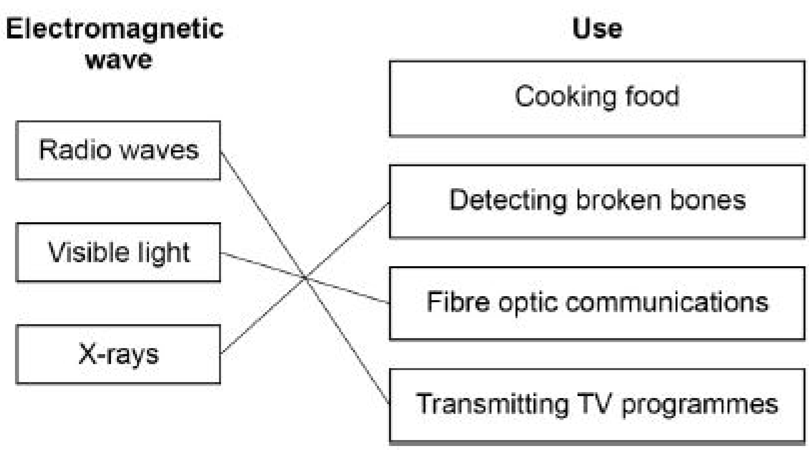
two correct readings from the bar chart which support their comparison

if no other mark scored, two correct readings from the graph scores ***1*** *mark*

1

[9]

6. (a)



additional line from a box on the left negates the mark for that box

3

(b)

Variable	Independent	Dependent	Control	
Distance between infrared detector and surface of cube				
Starting temperature of water inside cube			✓	1
Temperature measured by infrared detector		✓		1
Type of surface	✓			1

do **not** accept more than one tick per row

(c) 0.5 °C

1

(d) any **one** from:

- 26(.0 °C to) 69(.0 °C)
- 69(.0 °C to) 26(.0 °C)

ignore 43(.0 °C)

1

(e) 3 bars correctly plotted

allow a tolerance of +/- ½ of a small square
allow any width, bars touching or not
*allow **1** mark for 2 bars correctly plotted*

2

3 bars correctly labelled

1

(f) any **one** from:

- matt black is the best emitter / radiator

  allow silver is a poor emitter / radiator

- shiny silver is the worst emitter / radiator allow black is a good emitter / radiator

  allow an answer in terms of highest / lowest temperature

  allow matt white and shiny black are (almost) the same at emitting / radiating

  ignore any reference to absorption / reflection

1

(g) $v = f \times \lambda$

1

(h) 300 000 000 = f × 500

1

$f = \frac{300\ 000\ 000}{500}$

1

f = 600 000

1

hertz / Hz

1

[17]

7. (a)

*an answer of 7 (s) gains **2** marks*

(4 − 0) + (10 − 7)
or 4 + 3
or 10 − 3

1

7 (s)

1

(b)

*an answer of 0.2 (m/s^2) gains **2** marks*

gradient = $\frac{0-2}{24-14}$

allow readings from any two points correctly substituted

1

(−) 0.2 (m/s^2)

allow correct use of a = $\frac{\Delta v}{t}$

1

(c) (there are no wires) to get tangled / disconnected

allow easier to move arms

allow wires are inconvenient

allow easier to transfer data

1

(d) wave speed = frequency × wavelength

allow v = f λ

allow any correct re-arrangement

1

(e)

*an answer of 0.125 (m) or 0.13 (m) scores **3** marks*

300 000 000 = 2 400 000 000 × λ

1

$\lambda = \frac{300\,000\,000}{2\,400\,000\,000}$

1

λ = 0.125 (m)

allow λ = 0.13 (m)

1

(f) range is far enough (for most uses)

1

power is not too great so the battery will not drain quickly

allow power not too great so the phone will not overheat

allow the range per milliwatt is greatest or 4 metres

1

[11]