MC /20	
Long /110	
Total /130	
%	

Nat 5 W&R Prelim Revision Answers

1. B
2. C
3. C
4. B
5. B
6. E
7. B
8. B
9. A
10. E
11. B
12. E
13. B
14. C
15. C
16. B
17. C
18. B
19. D
20. B

21.

a) Microphone 1 as it has a shorter distance to travel 2

b) d = v x t 3
d = 1800 x 0.45
d = 810

c) D = v x t ground d = v x t air 4
D = 1800 x 0.8 d = 340 x 0.8
D = 1440 m D = 272 m

1440 – 272 = 1168 m

(9)

22. a) It has the correct half life and it is a gamma emitter 2

b) Use tongs, wear gloves, do not eat when handling radioactive sources, never point sources at anyone, ensure that there is proper labelling on radioactive sources 2

c) 24 days = 4 ½ lifes
2400 kBq ⇨ 1200 kBq ⇨ 600 kBq ⇨ 300kBq ⇨ 150kBq
2

d) 6000 kBq ⇨ 3000 kBq ⇨ 1500kBq ⇨ 750 kBq
4
3 ½ lifes = 24hrs 1 ½ life = 8hrs

(10)

23.

a) γ-radiation, β-particles, α-particles 1

b) A Helium nucleus 1

c) Ionisation is when an atom loses or gains an electron to become positively charged or negatively charged. 2

d) α-particles are not suitable to use as a human tracer as it has a high ionisation density and it cannot be detected outside the human body 2

e) To cure cancer or instrument sterilisation 2

(8)

24. Radiation is used in hospitals for the treatment of cancer. During the treatment care is taken to ensure that healthy tissue is not exposed to too much radiation. Too much exposure could be harmful. The risk of harm to tissue depends on the absorbed dose.

a) Absorbed dose is the energy absorbed per kilogram. The unit is the Gray 2

b) The type of radiation 1

c) 3

$H = D\,\omega_R$

$500 = D \times 6$

$D = 83.3\ \mu Gy$

d)

(i) Appropriate shielding 2
Increase the distance between themselves and the radioactive source

(ii) A film badge has different types, and thickness's of material covering the film. Once the film has been processed it allows people to see **what type** and **how much exposure** someone has had. 2

(10)

25. a) .

Quantity	Unit
Absorbed Dose	Gray (Gy)
Equivalent Dose	sievert (Sv)

2

b)

(i) The time that it takes the ACTIVITY of a source to half 1

(ii) A After 10 hours the source will have halved 5 times

800 kBq ⇨ 400 kBq ⇨ 200 kBq ⇨ 100 kBq ⇨ 50 kBq ⇨ 25 kBq

B After 10 hours the source will have halved 4 times

800 kBq ⇨ 400 kBq ⇨ 200 kBq ⇨ 100 kBq ⇨ 50 kBq 5

(iii) Use shielding and increase the distance between himself and the sources. 2

(10)

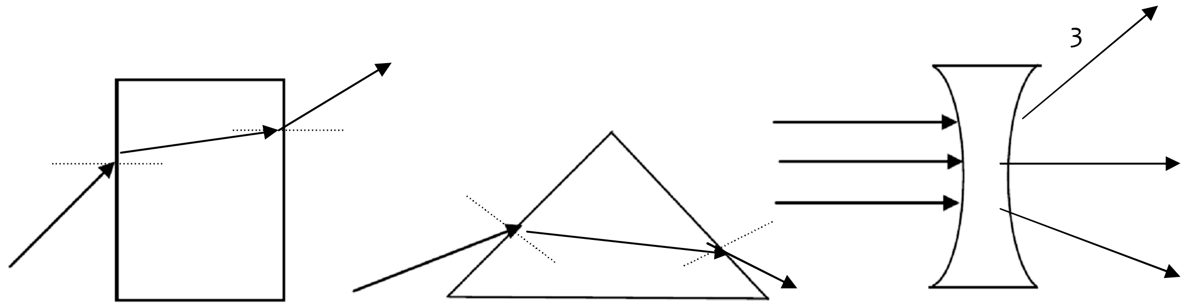
26. X 8000 20mins 4000 40mins 2000 60mins 1000 80mins 500 100mins 250 120 mins 125Bq

Y 2000 30 mins 1000 60mins 500 90 mins 250 120mins 125Bq

120 mins and the activity will be 125Bq 6

27. Four pupils were asked to find out as much as they could about the refraction of light and the use of lenses.

a)



3

b) i the normal 1

ii 56° 1

iii 35° 1

(6)

28.

a) $d = v \times t$ 3

$150 \times 10^9 = 3 \times 10^8 \times t$

$t = 500s$

b) $v = f \lambda$ 3

$3 \times 10^8 = f \times 280 \times 10^{-9}$

$f = 1.1 \times 10^{15}$ Hz

c) $v = f \lambda$ 4

$3 \times 10^8 = 7.5 \times 10^{14} \times \lambda$

$\lambda = 400$ nm UVA

(10)

29.

a) X – Gamma …. It is only absorbed by lead 4
   Y – Alpha ……. It is absorbed by paper

b) They would fog it 1

c) Because gamma rays can be detected outside the body, alpha would be absorbed by the body 1

d) So that the radioactivity is not within the patient for a long time. 1

e) 3 200 Bq ⇒ 1 600 Bq ⇒ 800 Bq 400 Bq 200 Bq 3

   4 ½ lifes = 180 mins 1 ½ life = 180 / 4 = 45 mins

f) 200 Bq ⇒ 100 Bq ⇒ 50 Bq ⇒ 25 Bq ⇒ 12.5 Bq 2

30.

a) 0.3 m 1

b) 0.5 Hz 3

c) 4 m 3

d) $v = f \lambda$ 3
   $v = 0.5 \times 4$
   $v = 2$ m/s

(10)

31.

a) v = f λ 3

v = 40 000 x 0.0083

v = 332 m/s

b) t = d/v 4

t = 120 / 332

t = 0.36s

c) d = v x t 4

d = 332 x 0.3

d = 99.6 m

(11)

32.

a) A - D because this is the shortest distance 2

b) $t = d/v$ 3

$t = 500 / 2 \times 10^{8}$

$t = 2.5 \times 10^{-6}$ s

c) $T = 1 / f$ 3

$T = 1 / 5 \times 10^{14}$

$T = 2 \times 10^{-15}$ s

(8)

DATA SHEET

Speed of light in materials

Material	*Speed* in $m\,s^{-1}$
Air	$3{\cdot}0 \times 10^8$
Carbon dioxide	$3{\cdot}0 \times 10^8$
Diamond	$1{\cdot}2 \times 10^8$
Glass	$2{\cdot}0 \times 10^8$
Glycerol	$2{\cdot}1 \times 10^8$
Water	$2{\cdot}3 \times 10^8$

Gravitational field strengths

	Gravitational field strength on the surface in $N\,kg^{-1}$
Earth	9·8
Jupiter	23
Mars	3·7
Mercury	3·7
Moon	1·6
Neptune	11
Saturn	9·0
Sun	270
Uranus	8·7
Venus	8·9

Specific latent heat of fusion of materials

Material	*Specific latent heat of fusion* in $J\,kg^{-1}$
Alcohol	$0{\cdot}99 \times 10^5$
Aluminium	$3{\cdot}95 \times 10^5$
Carbon Dioxide	$1{\cdot}80 \times 10^5$
Copper	$2{\cdot}05 \times 10^5$
Iron	$2{\cdot}67 \times 10^5$
Lead	$0{\cdot}25 \times 10^5$
Water	$3{\cdot}34 \times 10^5$

Specific latent heat of vaporisation of materials

Material	*Specific latent heat of vaporisation* in $J\,kg^{-1}$
Alcohol	$11{\cdot}2 \times 10^5$
Carbon Dioxide	$3{\cdot}77 \times 10^5$
Glycerol	$8{\cdot}30 \times 10^5$
Turpentine	$2{\cdot}90 \times 10^5$
Water	$22{\cdot}6 \times 10^5$

Speed of sound in materials

Material	*Speed* in $m\,s^{-1}$
Aluminium	5200
Air	340
Bone	4100
Carbon dioxide	270
Glycerol	1900
Muscle	1600
Steel	5200
Tissue	1500
Water	1500

Specific heat capacity of materials

Material	*Specific heat capacity* in $J\,kg^{-1}\,°C^{-1}$
Alcohol	2350
Aluminium	902
Copper	386
Glass	500
Ice	2100
Iron	480
Lead	128
Oil	2130
Water	4180

Melting and boiling points of materials

Material	*Melting point* in °C	*Boiling point* in °C
Alcohol	−98	65
Aluminium	660	2470
Copper	1077	2567
Glycerol	18	290
Lead	328	1737
Iron	1537	2737

Radiation weighting factors

Type of radiation	*Radiation weighting factor*
alpha	20
beta	1
fast neutrons	10
gamma	1
slow neutrons	3

$$E_p = mgh$$

$$E_k = \frac{1}{2}mv^2$$

$$Q = It$$

$$V = IR$$

$$R_T = R_1 + R_2 + \dots$$

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$$

$$V_2 = \left(\frac{R_2}{R_1 + R_2}\right)V_s$$

$$\frac{V_1}{V_2} = \frac{R_1}{R_2}$$

$$P = \frac{E}{t}$$

$$P = IV$$

$$P = I^2R$$

$$P = \frac{V^2}{R}$$

$$E_h = cm\Delta T$$

$$p = \frac{F}{A}$$

$$\frac{pV}{T} = \text{constant}$$

$$p_1V_1 = p_2V_2$$

$$\frac{p_1}{T_1} = \frac{p_2}{T_2}$$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$d = vt$$

$$v = f\lambda$$

$$T = \frac{1}{f}$$

$$A = \frac{N}{t}$$

$$D = \frac{E}{m}$$

$$H = Dw_R$$

$$\dot{H} = \frac{H}{t}$$

$$s = vt$$

$$d = \bar{v}t$$

$$s = \bar{v}t$$

$$a = \frac{v - u}{t}$$

$$W = mg$$

$$F = ma$$

$$E_w = Fd$$

$$E_h = ml$$