| | | |
|---|---|---|
| ① C | ④ E | ⑦ D |
| ② A | ⑤ E | ⑧ D |
| ③ A | ⑥ C | ⑨ D |

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10 ai). P Only thermometer that can measure Temps about zero °C.

aii). Q Temp range just above + below body temp [normal!] ie 37°C.

b). Put thermometer in mouth
Leave for about 2 minutes
Take out + read scale.

c). Temp 2°C above normal
Indicates fever + an infection.

---

11 a). To measure temperature [how hot or cold]

b). Clinical thermometer has
- Narrow liquid column.
- Smaller temp range. [35 → 42°C].
- Triangular lens shape to magnify column.

12 a). Infra Red.

b). An increase/decrease in body temp of as little as 5°C can be very serious.

c). Thermistor.

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13 a). Bells collect the sound.
Sound travels up rubber tubing to the earpieces.
Earpieces block [unwanted] outside noises.

b). So all sound goes into the bell.
So bell collects as much sound energy as possible.

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14 a) • Jet • Busy Road • Pneumatic drill

b). 0 dB

c i). Sound levels above 90 dB damage hearing

ii). School levels will be lower because buildings will absorb some of the sound energy.

15 a). 15 Hz (any reasonable below 20 Hz).

b). 20,000 Hz.

c) decibel (dB)

d). $d = s.t$

$d = 340 \times [0.2]$

$d = 68$ m

e). To examin unborn babies make womb.

16 a). decibels – dB.

b). how frequencies :– 0 → 150 Hz

c). To block unwanted / outside noises.

17 a). 60,000 Hz.

b). The bat

c) i Sound width frequency above 20,000 Hz.

ii between 30,000 + 60,000 Hz

eg 40,000 Hz.

18 a). The tissue absorbs energy from the laser to produce heat which seals blood vessels.

b).

c). light → heat

d). blue → green → red

e) To examine bones for breaks.

---

19 a i). The light is not focused on the

a ii). long sight

a iii).

a iv). D.

b i). Blue

b ii). Red → Green → Blue.

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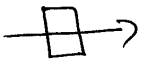
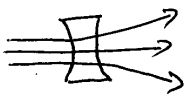
20 a)



b).



c).

21. a). Laser Light

b). Ultraviolet

c). X-Rays

---

22 a). Ultraviolet

b). (i) Detect broken bones.

(ii) Photographic film

c). Infrared.

d). UV can damage DNA in skin cells.

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23 P: Gamma (passes through all materials)

Q Alpha (stopped totally by paper)

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24 Nucleus — Protons + Neutrons

Orbit — Electrons.

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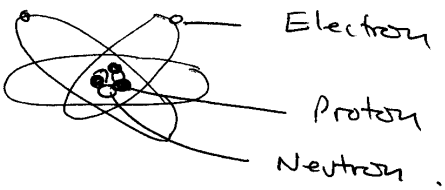
25 a)



25bi) Gamma

bii). Alpha.

biii) Sieverts.

25c). • Use tongs when handling radioactive sources.
• Handle sources for a short a time as possible.

---

26 ai). Damage / Kill them

aii). Gamma is not absorbed much by normal tissue

aiii) To maximize dose to Tumour BUT minimize dose to normal tissue

b). Turns film dark / foggy / black.

27a).i) Sound with a frequency above 20,000 Hz.

ii) $d = v \cdot t$

$0.02 = 1600 \cdot t$

$t = \frac{0.02}{1600}$

$t = 1.25 \times 10^{-5}$ s

$t = ?$

$d = 2$ cm $= 0.02$ m

$v = 1600$ m/s

b i). uls pulses sent out by transducer
some pulses are reflected at tissue boundaries (different densities)
reflections picked up by transducer
computer builds reflections into a picture.

b ii) The cells/DNA are not damaged by uls but could be by x-rays

---

28 a i). It is below 90 dB.

a ii). $d = s \cdot t$

$d = 1500 \times 30 \times 10^{-6}$

$d = 0.045$ m

$d$ to ear $= \frac{0.045}{2} = 0.0225$ m

$= 2.25$ cm

ok to $t/2 = 15 \times 10^{-6}$

a iii). Any reasonable between 20 → 20,000 Hz.
eg 800 Hz.

b). uls pulses sent out by a transducer
some pulses are reflected at tissue boundary
(different density)
reflections are picked up by transducer
computer builds reflections into a picture.

29 ai). • Light is shone into the patient by total internal reflection using bundle A.

• Light reflects off inside of patient then travels up bundle B by total internal reflection to the eye.

aii) It is / little infrared (heat)

aiii) Discharge tube produces less heat [for the same amount of light].

b). heat → electrical.

c) i) 0·03 mV

ii) between 0·030 and 0·036

0·033 mV

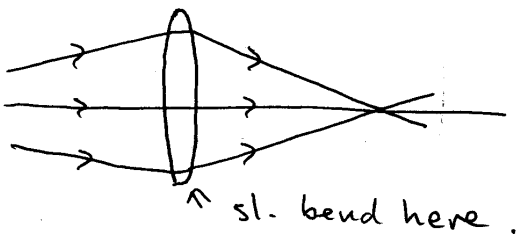
---

30 ai). Person can only see distant objects clearly.

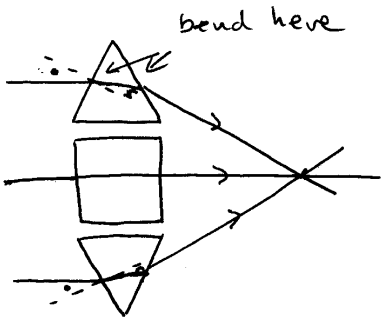
Only light from [or] distant objects is focused onto the retina.

aii) $FL = \frac{1}{P} = \frac{1}{2.5} = 0.4\text{m}$

b)



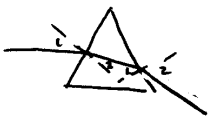
31 a i).




- ∠ of incidence
- ∠ of refraction

a ii). The normal.

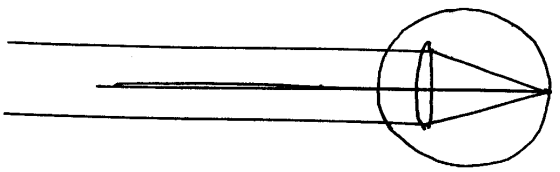
a iii). see above on



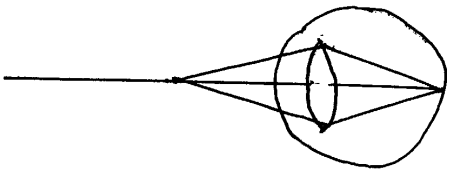
① ∠ incidence
② ∠ refraction.

b). Convex.

32 a i).



lens should look thinner!.



lens should look thicker!

a ii)


b). $P = \frac{1}{FL} = \frac{1}{0.025} = 40\,D$

33a). Person can only see distant objects clearly
OR
Only light from distant objects is focused onto the retina.

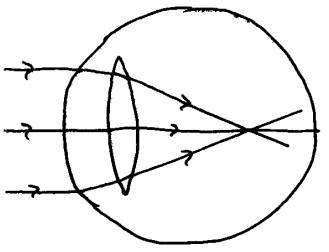
b). ① ② ie both convex (= +)
higher power → more curved.

c). $FL = \frac{1}{P} = \frac{1}{2.5} = 0.4m$

34 a). Light slows down when passing through a denser material.

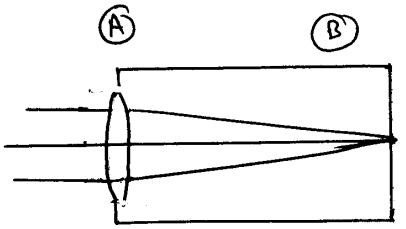
(N.B) Refraction is actually a change of speed of a wave in different media densities.
We OBSERVE refraction by the subsequent bending of waves at density boundaries

bi).



bii). $P = \frac{1}{FL} = \frac{1}{0.4} = 2.5D$ FL = 400m = 0.4m

35 a i).




a ii)

$$P = \frac{1}{FL} = \frac{1}{0.016} = 62.5\ D$$

FL = 16 mm
FL = 0.016 m

---

36 a) electromagnetic spectrum.

b). Gamma — Sterilize Medical Instruments.
UV — Tanning with sun-ray lamp
IR — Treating injuries with heat-lamp.

b ii). Longest λ → IR
Highest f → Gamma.

---

37 a). Microwaves Ultraviolet

b). Any ✓ microwaves, IR, TV + Radio.

c). Photographic film

d). Treating muscle injuries ✓
Thermograms.

38 ai). Argon / Helium-Neon / Rhodamine.

ii). Krypton fluoride.

iii). Treat skin conditions.

b). Colour changes. (note word "observed"!)

c) $E = P.t$

$E = 200 \times [10 \times 60]$

$E = 120{,}000$ J.

---

39 ai) Some Beta particles are absorbed by human/body tissue.

ii) Damage DNA or change/kill cells.

bi A). Turns dark (black/foggy.

B). The darker the film the more radiation received / higher dose.

bii).
- Because technician has to handle the bottle (a lot)
- their hand will receive a higher dose than the rest of their body

biii). Minimise time handling the radioactive source.

40 a). It takes 5730 years for the activity of the soure to half.

b i). Becquerels [Bq]

b ii). When ever radiation hits a crystal a flash of light is given out, these flashes are counted.
Different crystals are used for different types of radiation.

b iii). Can turn photographic film dark/black/foggy.

41 a) Time taken for the Activity of a radioactive source to half.

b) i All alpha absorbed by paper.

ii Soure must be Beta no gamma would be absorbed by the paper.
20 hours too short a $t\frac{1}{2}$ to let mill run for several days.
source R.

c). Prevent radiation harming people near by.

d). $t\frac{1}{2}$ = 4 hours

42. ai). When an electron is removed [or added] to an atom to give it a charge.

aii). top plate is ⊕ bottom is (-ve)
alpha particles are +ve.
α particles repelled by top plate + attracted by the bottom plate.

b). α particles can only travel about 5cm in air.

c). Becquerels [Bq].

---

43 ai). The source is counted for 1 minute over a long period of time [≈ 30 mins]
Graph of counts vs time drawn.
to calculate $t_{\frac{1}{2}}$.

aii). $\frac{40}{10} = 4\ t_{\frac{1}{2}}$.

$1200 \xrightarrow{1} 600 \xrightarrow{2} 300 \xrightarrow{3} 150 \xrightarrow{4} 75$

75 counts per minute.

bi). Sieverts [Sv]

bii). Type of radiation
Type of tissue

44 a). $3\frac{1}{2}$ days.

b). Count activity from source for 1 minute with counter + stopclock.

Repeat this over an extended time [30 → 60 mins] using wall clock.

Plot graph of counts vs time to calculate $t_{\frac{1}{2}}$.

c). 200 → 100 → 50 → 25 → 12.5 (1, 2, 3, 4) 4 $t_{\frac{1}{2}}$.

$3\frac{1}{2}$ days × 4 $t_{\frac{1}{2}}$ ⇒ 14 days.

Prepare sample May 3rd at 9.30am.

45 ai). 20 → 10 → 5 → 2.5 → 1.25 (1, 2, 3, 4) 4 $t_{\frac{1}{2}}$.

52 hours ÷ 4 ⇒ $t_{\frac{1}{2}}$ = 13 hours.

aii). Some of Beta particles would be absorbed by surrounding tissue [Reduce signal + could harm patient]

aiii). To treat the cancer the cells must be killed, so a higher dose is needed.

b). Sieverts (Sv).