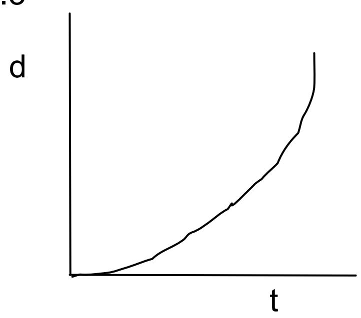
Memo

1.1 distance – d (1)

1.2 time – t (1)

1.3



(1)

1.4 To get a straight line (1)

1.5 a = 2 × slope of s vs t^2 graph ✓
= 2 × (1.06-0)/(10.6-0.6) ✓✓
= 0.21 $m.s^{-2}$ ✓ (4)

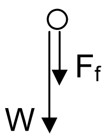
1.6 a possible answer:

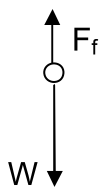
- use a ticker timer for constant time intervals ✓
- measure distances over a large no of intervals with a ruler ✓
- calculate v at two places on the tape ✓
- calculate the acceleration from the change in velocity ✓ (4)

2.1 $v^2 = u^2 + 2as$
$0 = 25^2 + 2(-10)s$ ✓✓
s = 31.25 m ✓ (3)

2.2 v = u + at
0 = 25 – 10t ✓
t = 2.5 s ✓ (2)

2.3 up: ✓ down: ✓





- while moving up, the acceleration will be greater than that without air resistance ✓
- while moving down, the acceleration will be less than that without air resistance ✓ (4)

2.4 If the cricketer causes the momentum of the ball to change of a longer period of time ✓, the resultant force experienced by the hand will be less. ✓ (2)

3.1 Vertical height, h, is used to calculate the potential energy at the top✓

After the collision, PE top equals KE at bottom ✓
Velocity can be calculated from KE ✓ (3)

3.2 In an isolated system, the total momentum is constant (2)

3.3 p_{after} = mv
= (0.5)(0.48) ✓
= 0.24 $kg.m.s^{-1}$ ✓ (2)

3.4 p_{before} = p_{after} ✓
0.002v + 0 = 0.24 ✓
v = 120 $m.s^{-1}$ ✓ (3)

3.5 KE_{before} = ½mv^2
= ½$(0.002)(120)^2$
= 14.4 J ✓

KE_{after} = ½mv^2
= ½$(0.50)(0.48)^2$
= 0.06 J ✓

Inelastic as $KE_{before} \neq KE_{after}$ ✓ (3)

3.6 They are dangerous as 14.4J is much larger than 2J and so can easily puncture skin. (could also mention eyes etc.) (2)

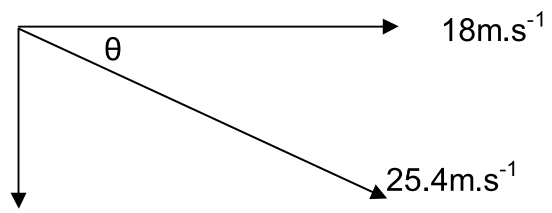
4.1 PE = mgh
= (0.056)(10)(16) ✓
= 8.96 J ✓ (2)

4.2 18$m.s^{-1}$ (1)

4.3 Total KE = 8.96 ✓ + ½$(0.056)(18)^2$ ✓
= 8.96 + 9.07
= 18.03 J ✓ (3)

4.4 KE = ½mv^2
18,03 = ½$(0.056)v^2$ ✓
v = 25.4 $m.s^{-1}$ ✓ (2)

4.5



4.6 cos θ = 18/25.4 ✓

$\theta = 44.9^{o}$ ✓ (2)

4.7 no air resistance: KE = 18.03 J

with air resistance KE = ½(0.056)$(22)^2$ = 13.55 J ✓

work done against air resistance = 18.03 – 13.55 = 4.48 J ✓ (2)

5.1 $c = f\lambda$

$3\times10^8 = 6.5\times10^{14}\ \lambda$ ✓

λ = 462 nm ✓

colour is indigo or blue ✓ (3)

5.2.1 green ✓, as all colours reflected by white, but green was the only incident colour✓ (2)

5.2.2 black ✓, blue writing cannot reflect green and so writing appears black (no cololur) (2)

5.3 magenta (2)

5.4.1

- atmosphere uses up UV to form O_2 ✓
- atmosphere uses up UV to break O_3 into O_2 ✓
- atmosphere therefore blocks 98% of harmful rays ✓ (3)

5.4.2 more UV light will pass through the atmosphere ✓ (NOT global warming) (1)

6.1.1 longitudinal wave (1)

6.1.2 similarity: period ✓ (not wavelength)
difference: amplitude or phase ✓ (2)

6.1.3i 0 cm

6.1.3ii $[(-2.6) + (1.7)] \times 10^{-4}$ cm ✓
$= -0.9 \times10^{-4}$ cm ✓ (3)

6.2.1 on answer sheet

6.2.2 alternating bright and dark lines (1)

6.2.3 alternating bright and dark lines, but closer together (1)

6.2.4 ± 500nm (1)

7.1 D (2)

7.2 downwards in plane of paper (2)

7.3 magnetic field from magnet interacts ✓ with magnetic field from current
where the fields interact, they produce an area of high density ✓
wire moves to reduce the high density of field lines (2)

8.1

- Force on current carrying wire in magnetic field ✓
- Force on DA and BC in opposite directions ✓
- Coil experiences a turning force ✓
- Commutator ensures coil keeps turning in the same direction ✓ (4)

8.2 Vertical ✓
as no current **or** forces through axis of rotation ✓ (2)

8.3 electrical energy ✓→ mechanical energy ✓ (2)

8.4

- Friction in bearings (mechanical → heat)
- Heating in wire (electrical → heat) (2)

9.1 emf induced is directly proportional to the rate of change of
flux linkage (2)

9.2 emf $= -N\ \Delta\Phi/\Delta t$
$= 240 \times (2.5\times10^{-4})$ (change in B ✓/ change in t) ✓
$= 0.014$ V ✓ (3)

9.3 answer sheet

9.4

- more turns
- stronger magnet
- faster swinging of magnet
- bigger area of coil (any three) (3)

10.1 B (2)

10.2 use slip rings (2)

10.3 answer sheet

10.4

- changing current in primary coil causes a changing magnetic field ✓
- this changing B field through the secondary coil causes an induced emf in secondary coil ✓
- no of coils in secondary must be less ✓ to have smaller flux linkage in secondary coil✓ (4)

10.5i $\frac{N_p}{N_s} = \frac{V_p}{V_s}$

$\frac{15}{1} = \frac{230}{V_s}$ ✓✓ V_s = 15.3 V ✓ (3)

10.5ii not all flux from primary enters secondary coil ✓
Heating in wires ✓ (2)

11.1 ΔE = -4.026 – (-5.990)
= 1.964 eV ✓

ΔE = (1.964)(1.6×10^{-19})
= 3.142 ×10^{-19} J ✓

ΔE = hf
3.142 ×10^{-19} = 6.6 ×10^{-34} f ✓
f = 4.74×10^{14} Hz ✓ (4)

11.2 each element has its own unique energy levels✓ and so has its own unique spectra that can be used to identify the element✓ (2)

12.1 E = hf
= (6.6 ×10^{-34})(1.67 ×10^{15}) ✓
= 1.10 ×10^{-18} J ✓ (2)

12.2 hf = W_f + E_K
1.10 ×10^{-18} = W_f + 3.0 ×10^{-19} ✓
W_f = 8 ×10^{-19} J ✓

This is the minimum amount of work that must be done to free one electron from the metal. ✓ (3)

12.3
- intensity doubled, no of photons doubled ✓so no of electrons released is doubled ✓
- same frequency, same photon energy ✓, electrons ejected with same kinetic energy ✓ (4)

13.1
- heading
- label and unit – x axis
- label and unit – y axis
- scale – x axis
- scale – y axis
- plotting all points
- best fit line (7)

13.2 $\mathbf{E_K = hc\frac{1}{\lambda} - W_f}$

i W_f = y int✓ = -3.34 × 10^{-19} J ✓

ii hc = slope ✓= 2.0 × 10^{-7} ✓
h = 6.67× 10^{-34} ✓ (5)

13.3 new line is parallel ✓to old but bigger negative y int ✓ (2)

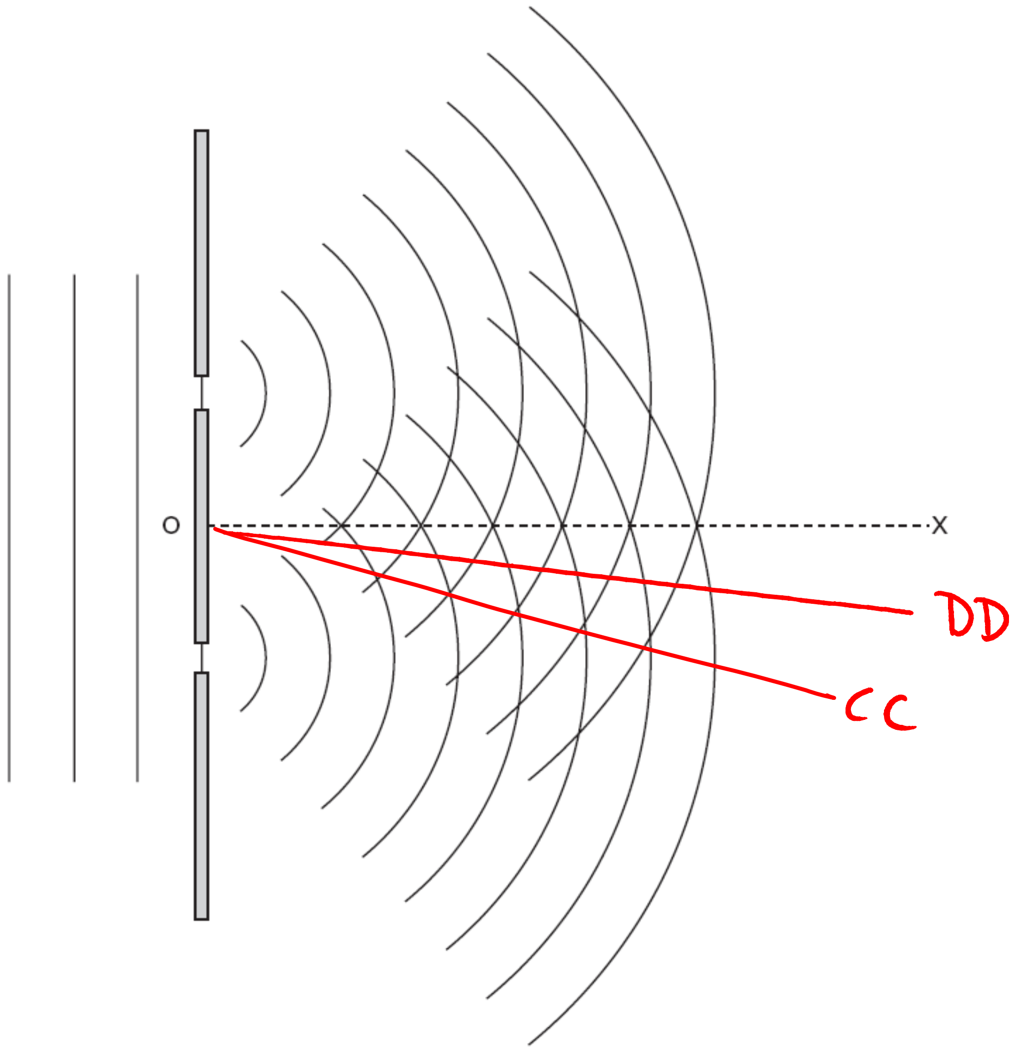
14.

- 2 semiconductors in contact.
- One n-type has an excess of electrons, while other (p-type) has "holes"
- When a minimum pd is applied in one direction, electrons are excited and jump to the "holes"
- When they make this quantum jump, they release a photon of energy whose frequency matches the energy of the jump (4)

ANSWER SHEET

NAME: ____

Question 6.2



(2)

Question 9.3

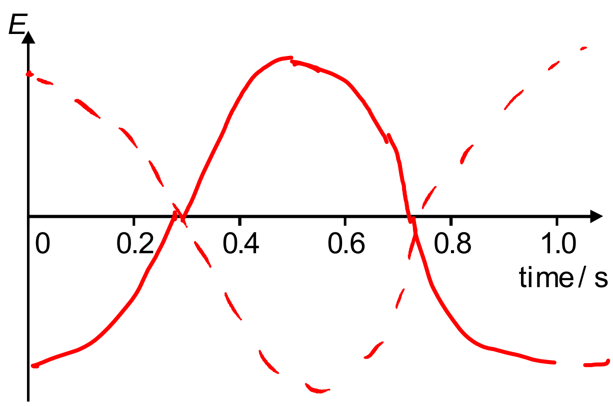


Figure 3

$\frac{d\phi}{dt}$ (still give 2 but out of phase)

$-\frac{d\phi}{dt}$ (correct)

(2)

must have zeros at correct positions

Question 10.3

This diagram represents an emf produced by an a.c. generator. On the same diagram, sketch the emf that would be produced by a d.c. generator.