ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

MARKING SCHEME

JUNE 2012

PHYSICS **9188/5**

1 (a) (i) Strain = $\frac{\text{increase in length}}{\text{original length}}$ B1

Stress = $\frac{\text{Force}}{\text{cross sectional area}}$ B1

(ii) failure due to sustained stress, below yielding stress B1B1

- combined with high T°C/ and time B1

(iii) high melting point B1

(iv) Filament exposed to high temperature strained by its own weight sags due to creep B1B1

(b) (i) Friction and induction B1
rubbing: transfer of electron from one material to another B1
induction: attraction of unlike charges and repulsion of like charges B1

(ii) $F = \frac{q_1 q_2}{4\pi\varepsilon_o r^2}$ B1

$E = \frac{F}{q_2}$ B1

$= \frac{qq_2}{4\pi\varepsilon_o r^2} \times \frac{1}{q_2} = \frac{q}{4\pi\varepsilon_o r^2}$ A0

(iii) $E = \frac{2.5\times10^{-9}}{4\pi\times8.85\times10^{-12}}\left(\frac{1}{1.5^2}-\frac{1}{1^2}\right)$ C1, C1

$= -12.5$ V/m A1

(c) (i) emission – bright lines on dark background B1

absorption – dark lines on bright back ground B1

correct background B1

(ii) electrons in an atom gain energy (excitation) move to different energy levels, B1

emit photon energy of different frequency $(E_2 - E_1 = hf)$ B1

(iii) $-1.5-(-13.6)\times1.6\times10^{-19}$

$= \quad 12.1 + 1.6 \times 10^{-19}$ C1

$= \quad 1.94 \times 10^{-18}\,J$ A1

2 (a) Induced emf. is directly proportional to the rate of change of magnetic flux linkage. B1

(b) (i) $\varnothing = BA$

$= \quad 0.05 \times 5 \times 10^{-4}$ C1

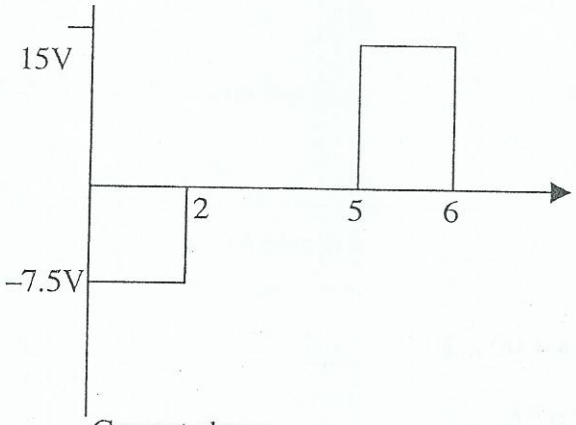
$= \quad 2.5 \times 10^{-5}\,Wb$ A1

(ii) $E = -\dfrac{N\ d\ \Phi}{dt}$

$= -600 \times \dfrac{0.05}{2\times10^{-3}} \times 5 \times 10^{-4}$ C1

$= -7.5V$ A1

(iii)



Correct shape B1
Labelled 15V (5 – 6) B1
Labelled 7.5 V (0 – 2) B1
$E = 0$ for (2 – 5) B1

(iv) increasing No of turns B1
- increasing rate of change of flux B1
- increasing area of coil B1
- inserting iron core B1 max B3

3 (a) change in volume — B1
change in length — B1
change in resistance — B1
change in potential difference — B1
max 2

(b) (i) 150° to 2 000°C — B1

(ii) It is the range where temperature varies linearly (uniformly) with the physical property — B1

any environment that is between 150°C – 2 000°C — B1B1

(c) (i) 1. Counteract the electromagnetic induction effects/ which induces a back emf. — B1B1

2. to nullify the change in resistance leads to platinum coil due to temperature change. — B1 B1

(ii) - more accurate — B1
- needs less sensitive electric equipment — B1
- Better for small steady temperature differences — B1
max 2

4 (a) Electric force per unit charge — B1

(b) (i) $E = -\frac{\Delta V}{dt} = \frac{28}{2.0 \times 10^{-3}}$ — B1

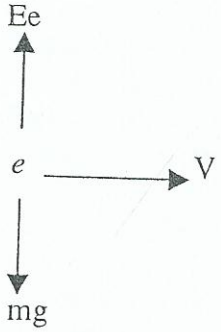
$E = 14\ 000\ V\,m^{-1}$ — A1

(ii) F = Ee

= $14\,000 \times 1.60 \times 10^{-19}$

= 2.24×10^{-5}N — A1

(iii)



B2

b (iv) *Horizontal motion*

$$t_H - \frac{S}{V} = \frac{2.00}{2.7\times10^{6}}$$

$$t_H = 7.4\times10^{-7}\text{s}$$ A1

Vertical motion

$$a = \frac{Ee}{me} = \frac{2.24\times10^{-15}}{9.11\times10^{-31}}$$

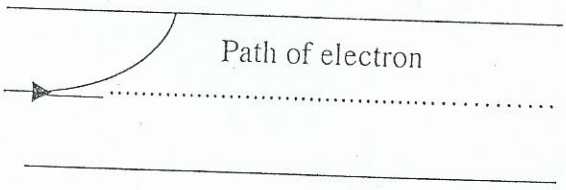
$$a = 2.46\times10^{15}\text{ms}^{-2}$$ B1

$$y = \frac{1}{2}at_v^2$$

$$t_v = 9.02\times10^{-10}$$ B1

$t_v < t_H$ B1

Therefore electron hits top plate B1



B1

5 (a) (i) - Reduces the gain B1

(ii) - For no saturation the inputs to the op=amp must be as close as possible to each other. B1

since non-inverting is earthed the inverting input should be also close to earth potential hence virtual earth principle. B1

(b) (i) $A = -\frac{Rf}{R_i} = -\frac{100k\Omega}{10k\Omega} = -10$ C1A1

(ii) - when cold the thermistor resistance is high and potential at J is negative.

- the negative input is inverted by op-amp, therefore diode conducts.

- relay is energized and so switches on heater B1

- when hot, potential at J is positive so output is negative B1
- relay does not operate since diode is reverse biased B1

(iii) - $V_i = \frac{5.0}{-10} = -0.50V$ max 4

p.d across $R_2 = -0.50 - (-10.0) = 9.5V$ C1

$\frac{R_2}{R_1 + R_2} \times 20 = 9.5 \longrightarrow R_2 = 1.81M\Omega$ C1A1