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Mark Scheme Summer 2007

GCE

GCE Salters Horners Physics (6752/01)

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1. (a) Material properties:

Strength - Force/ load/stress required to **break** / Strong - large force required to **break** ✓

Brittle - shatters/snaps/fractures / cracks (under force) / breaks with no/little plastic deformation/breaks with little strain [ignore reference to size of force needed eg. cracks easily - mark awarded for 'cracks'] ✓

Plastic - does not return to original length (when load removed) / deformation is permanent ✓ **3**

(b) Maximum force:

Use of $A = \pi r^2$ ✓
Use of $F = \sigma \times A$ ✓
Correct answer [193 (N)] ✓ **3**
[accept 190 - 193 N to allow for rounding errors] [no u.e]
[2 out of 3 for correct reverse working out]

Example:
$F = \sigma \times A$
$A = \pi r^2 = (0.127 \times 10^{-3})^2 \times \pi$
$= 5.07 \times 10^{-8}\ m^2$
$F = 3.8 \times 10^9\ Pa \times 5.07 \times 10^{-8}\ m^2$
$= 193\ N$

(c) Extension calculation:

Use of $\varepsilon = \sigma / E$ ✓
Correct answer for ε [0.015]
Correct answer for extension [0.017 m] ✓ **3**
[allow 0.016 - 0.017 m to allow for rounding errors]
[allow 1st 2 marks for correct substitution into E= Fl/xA] ✓

Example:
$\varepsilon = \sigma / E$
$= 2.00 \times 10^9\ Pa / 1.31 \times 10^{11}\ Pa$
$= 0.015$
extension = ε x length = 0.015 x 1.1m = 0.017 m (1.7 cm)

(d) Polymer:

Long chain ✓
Of repeating units / of monomers / molecule /atoms ✓ **2**
[1 mark only for long chain of molecules]

Total 11

2. (a) Greatest power:

A real image is formed / image is seen on screen /combined f is positive ✓

Converging lens [mark dependant on 1st mark being correct] [allow covex] ✓ **2**

(b) Equation of line:

Gradient = -1 ✓

Intercept = 10 (m^{-1}) ✓

$1/v = -1/u + 10$ **OR** knowledge that y = 1/v and x = 1/u ✓ **3**

(c) Power of lens combination:

Intercept = $1/f$ **OR** use of $1/f = 1/u + 1/v$ ✓

$1/f = P = 10D$ ✓ **2**

(d) Power of diverging lens:

$P = 10 - 20 = -10D$ ✓ **1**

[allow ecf from (c)]

(e) Ray diagram:

Ray through centre of lens from light source ✓

Correct position of F (1 large square from lens - **need not be labelled**)

Ray parallel with axis to lens then through F / through F then parallel to axis from light source ✓

Distance between lens and screen = 6.5 - 7 cm **4**

[both ray marks may be awarded for any 2 of the possible 3 correctly drawn. Allow ecf for incorrect F position] ✓ ✓

Total 12

3. (a) Work function:

Energy needed for an electron to escape the surface / to be released (from the metal) ✓ **1**

(b) How current produced:

Any 3 from:
Photon of light passes energy to an electron
If energy above the work function/frequency above threshold ✓✓
Electron released as a photoelectron / photoelectron released / surface electron released ✓ **Max 3**
Moving electrons produce a current

(c)(i) Intensity of light increased:

More electrons released ✓

(ii) Frequency of light increased:

Electrons gain more (kinetic) energy ✓ **2**

(d) Photon energy:

Use of $f = v/\lambda$ or $E = hc/\lambda$ ✓
Correct answer for E (4.7×10^{-19} J or 2.96 eV) ✓ **2**
[allow 3.0 eV]

Example:
$f = v/\lambda = 3\times10^{8} / 4.2 \times10^{-7} = 7.1 \times 10^{14}$ Hz
$E = hf = 4.7 \times 10^{-19}$ J or 2.96 eV
OR
$E = hc/\lambda = 3\times10^{8} \times 6.63 \times 10^{-34} / 4.2 \times10^{-7}$
$= 4.7 \times 10^{-19}$ J or 2.96 eV

(e) Max kinetic energy:

Knowledge that ke_{max} = energy calculated in (d) - ϕ ✓
Correct answer for ke_{max} (0.26 eV or 4.2×10^{-20} J)
[allow 0.25-0.26 eV or $4.1 - 4.2 \times 10^{-20}$ J and allow ecf from (d)] ✓ **2**

Example:
ke_{max} = 2.96 eV - 2.7 eV
= 0.26 eV

(f)(i) Why current reduced:

Many / some electrons will not have enough (kinetic) energy to reach the anode / only electrons with large (kinetic) energy will reach the anode ✓ **1**

(ii) Stopping potential:

eV = (-) ke
V = ke / e = 0.26V ✓ **1**

Total 12

4. (a) Plane polarised:

Vibrations / oscillations	✓	
in one plane	✓	
OR		
double-headed arrow diagram ↕	✓	
with vibrations / oscillations labelled	✓	**2**

(b) Polarising filter:

• Intensity goes from maximum to minimum	✓	
• Twice per rotation / after 90°	✓	
• As filter only lets through vibrations in a particular plane		**3**
[marks may be gained from a clearly labelled diagram]	✓	

(c) Response of beetle:

Changed direction by 90^0 / turned through a right-angle	✓	**1**

(d) No moon:

Beetle moves in a random direction / in circles / appears disorientated	✓	**1**

Total 7

5. (a) Circuit:

Potential divider ✓ **1**

(b) Relay potential difference:

4 V ✓ **1**

Example:
5/15 x 12 = 4V

(c)(i) Resistance:

Recall of $R = \rho L/A$ ✓
Correct substitution of values into formula ✓
Correct answer [98(Ω)] ✓ **3**
[allow 97 - 98Ω to allow for rounding errors] [no u.e.]

Example:
$R = (3.4 \times 10^2 \times 1.44) / (100 \times 0.05)$
$= 98\ \Omega$

(ii) Combined resistance:

Use of $1/R_{Tot} = 1/R_1 + 1/R_2$ ✓
Correct answer for R [4.8Ω] ✓ **2**
[allow 4.7Ω - 4.8Ω to allow for rounding errors]

$1/R = 1/98 + 1/5$ (or $= 1/100 + 1/5$)
$R = 4.8\ \Omega$

(iii) Relay voltage:

P.d. across relay with ballast very similar to p.d across the relay alone / p.d. = 3.9 V / p.d. lower (slightly) ✓ **1**

(iv) Train on track:

Relay voltage becomes **very** small / zero ✓ **1**

(v) Wet ballast:

Any two-

- Combined resistance now small / $R_T = 0.45\ \Omega$
- Relay voltage now small / $V = 0.52$ V
- Relay voltage too small to trigger green light / signal remains red ✓✓ **2**

Total 11

6. (a) <u>High viscosity flow:</u>

Slower (than low viscosity flow) / greater time taken to flow the same distance / flows less distance in the same time ✓ **1**

(b) <u>Measurement of viscosity:</u>

Distance travelled by lava in a set time / time taken to travel a set distance / speed of lava flow ✓ **1**

(c) <u>Effect of cooling:</u>

(viscosity) increases ✓ **1**

(d) <u>Laminar/Turbulent flow:</u>

Any 3 points -

- Laminar - smooth
- Shown by at least 2 straight-ish lines
- Turbulent - flow causes whirlpools /eddies (or explanation involving energy)
- Turbulent flow shown on diagram with at least 3 lines resulting in eddies ✓✓ ✓ **Max 3**

(e) <u>Viscosity graph:</u>

Use a log scale / powers of 10 scale ✓ **1**

Total 7

Total marks for paper = 60