

## THERMAL EXPANSION

1. C

2. A

3. C

4.

(a) Differential expansion clear [1m]

Brass expands more than iron OR so brass on outside of curve or  
Equivalent [1m]

(b) (i) Clear that strip is heated by current [1m]

So circuit breaks [1m]

Cools remaking the circuit [1m]

(ii) Any circuit requiring a flashing light, such as a car indicator 1 [4]

[Total 6m]

5.

Either a large bulb / large amount of mercury (1)

Increase the volume change for a given temperature change (owtte) (1) [2]

Or a thin capillary / tube (1)

So greater movement of mercury for a given temperature change (1)

6.

(a) (i)  $120^{\circ}\text{C}$  or  $10^{\circ}\text{C}$  to  $10^{\circ}\text{C}$  B1 [1]

(ii) longer thermometer or wider bore or less mercury or smaller bulb not  
change liquid B1 [1]

(b) (i) measures small(er) change in temperature or small(er) range for same  
distance or large(r) expansion for (same) temperature rise B1 [1]

(ii) larger bulb or more liquid or narrower bore/tube or use liquid that expands  
more B1 [1]

(c) constriction/narrowing (accept 1st and 3rd marks on diagram)

mercury/thread breaks at constriction (on cooling) or thermometer is a

“maximum” thermometer

range different

more sensitive/divisions further apart

triangular cross-section/acts as lens

thin(ner) bulb (quick response to temperature change) ANY 3 lines B3 [3]

7.

(a) (i) most: gas

least: solid both required B1

(ii) because change of pressure (also) causes volume change (in a gas) B1

NOT ‘gas can be compressed’

(b) (i) two from:

expands uniformly (over required range)

remains liquid over required range  
expands more than glass / has high expansivity / expansion  
has (reasonably) low specific heat capacity.  
has low freezing point / lower freezing point than mercury max B2  
(ii) make (capillary) tube narrower (and longer) / thinner / smaller diameter B1  
make bulb larger (and tube longer) B1  
allow 'bore' for tube ignore 'smaller' ignore narrow thermometer

(c) allows fast(er) flow of heat to / from alcohol  
OR allows fast response (to temperature change)  
OR because glass is a poor conductor / good insulator (so needs to be thin for fast response)  
OR heat transfer more efficient / faster  
OR glass takes up less heat B1 [7]  
ignore reference to sensitivity ignore 'easier'

8.

- (a) (i) mercury or alcohol 1
- (ii)  $35 \pm 1$  1
- (iii) Make Hg move further/increase sensitivity 1 (3)
- (b) (i) cools 1
- liquid contracts 1
- (ii) correct position at 0 1 (3)

[Total 6m]