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□ ‹C or 10□ ‹C to 10□ ‹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 ± 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]