

**GCSE Topic 3 Physics AQA Mark Scheme**

**Q1. States of matter [3]**

- Solid (1)
  - Liquid (1)
  - Gas (1)
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**Q2. Melting and sublimation [3]**

(a)

- Particles gain energy (1)
  - Particles break free from fixed positions / start to move past each other (1)
- (b) Sublimation (1)
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**Q3. Diffusion [3]**

- Particles spread out (1)
  - From an area of high concentration to low concentration (1)
  - Caused by random particle motion (1)
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**Q4. Boiling and temperature [3]**

(a) Temperature stays the same (1)

(b)

- Energy is used to break bonds / overcome forces between particles (1)
  - Not to increase particle movement (temperature) (1)
-

### Q5. Density [3]

(a) Density = Mass  $\div$  Volume (1)

(b)

- Substitution:  $120 \text{ g} \div 60 \text{ cm}^3 = 2 \text{ g/cm}^3$  (1)
  - Final answer =  $2 \text{ g/cm}^3$  (1)
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### Q6. Gas pressure [3]

- Gas particles move randomly (1)
  - They collide with walls of container (1)
  - Each collision exerts a force, creating pressure (1)
- 

### Q7. Specific heat capacity [4]

(a)  $\text{J/kg}^\circ\text{C}$  (1)

(b)

- Equation:  $c = E \div (m \times \Delta\theta)$  (1)
  - Substitution:  $4200 \div (0.5 \times 20) = 420$  (1)
  - Final answer:  $420 \text{ J/kg}^\circ\text{C}$  (1)
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### Q8. Melting/boiling points [2]

(a)  $0^\circ\text{C}$  (1)

(b)  $100^\circ\text{C}$  (1)

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### Q9. Balloon in freezer [3]

- Cooling reduces particle energy (1)

- Particles move more slowly (1)
  - Pressure inside decreases, balloon shrinks (1)
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### Q10. Liquids [3]

(a)

- Particles are close together (1)
  - Arranged randomly / not in fixed positions (1)  
(b) Particles can move past each other, so liquids can flow (1)
- 

### Q11. Evaporation vs boiling [4]

(a)

- Evaporation happens at the surface only (1)
  - Can occur at any temperature below boiling point (1)
  - Boiling happens throughout the liquid at boiling point (1)  
(b) Example: drying clothes, puddles disappearing, sweating (any 1) (1)
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### Q12. Calculating density [2]

- Measure mass (using balance) (1)
  - Divide by volume (using ruler/water displacement) (1)
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### Q13. Particle motion [4]

(a) Heating a solid:

- Particles vibrate faster (1)

- Vibrations become stronger / further apart (1)  
(b) Cooling a gas:
  - Particles move slower (1)
  - Collide less often / pressure decreases (1)
- 

#### **Q14. Cooling in different containers [3]**

- Metal is a good conductor of heat (1)
  - Plastic is a poor conductor (insulator) (1)
  - So heat is transferred to surroundings faster in metal (1)
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#### **Q15. Pressure [3]**

(a) Pressure = Force  $\div$  Area (1)

(b)

- Substitution:  $200 \div 0.5 = 400$  (1)
- Final answer: 400 Pa (1)

#### **Q16. Density of solids and liquids [4]**

(a) Density = Mass  $\div$  Volume (1)

(b)

- Convert mass:  $300 \text{ g} = 0.300 \text{ kg}$  (allow use of  $\text{g/cm}^3$  if consistent) (1)
  - Substitution:  $0.300 \div 0.00005 \text{ m}^3$  OR  $300 \div 50$  (1)
  - Final answer:  $6 \text{ g/cm}^3$  or  $6000 \text{ kg/m}^3$  (1)
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#### **Q17. Boiling [5]**

(a)

- Particles gain energy (1)
  - Move faster (1)
  - Break bonds / overcome intermolecular forces and escape as gas (1)  
(b)
  - Boiling occurs at a fixed temperature throughout the liquid (1)
  - Evaporation occurs at the surface, at any temperature below boiling point (1)
- 

### Q18. Temperature and pressure [4]

(a)

- Higher temperature → particles have more kinetic energy (1)
  - Collide more frequently with container walls (1)
  - Collisions are harder (greater force), so pressure increases (1)  
(b) Pressure  $\propto$  1/Volume (at constant temperature) (1)
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### Q19. Cooling curves [4]

(a)

- Energy supplied is used to break bonds / overcome forces (1)
  - Temperature doesn't rise while bonds are breaking (1)
  - Energy increases potential energy of particles instead (1)  
(b) Heat loss to surroundings / uneven heating / impurities present (any 1) (1)
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### Q20. Specific heat capacity [4]

(a) J/kg°C (1)

(b)

- Equation:  $c = E \div (m \times \Delta\theta)$  (1)

- Substitution:  $16\,000 \div (2 \times 10) = 800$  (1)
  - Final answer:  $800 \text{ J/kg}^\circ\text{C}$  (1)
- 

### Q21. Solids and melting [5]

(a)

- Particles packed close together (1)
  - Arranged in fixed, regular lattice (1)
- (b)
- Particles vibrate faster as energy increases (1)
  - Vibrations become strong enough to break bonds (1)
  - Particles can move past each other in liquid state (1)
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### Q22. Pressure in fluids [5]

(a) Pressure = Force  $\div$  Area (1)

(b)

- Substitution:  $500 \div 0.25 = 2000$  (1)
  - Final answer:  $2000 \text{ Pa}$  (1)
- (c)
- Deeper liquid = greater weight of liquid above (1)
  - So force on area increases, increasing pressure (1)
- 

### Q23. Latent heat [5]

(a)

- Energy needed to change state of  $1 \text{ kg}$  (1)

- Without a change in temperature (1)  
(b)
  - Energy used to break intermolecular forces (1)
  - Increases potential energy of particles, not kinetic (1)
  - Temperature stays constant until change of state complete (1)
- 

#### **Q24. Cooling faster in metal [3]**

- Metal is a good conductor (1)
  - Transfers heat to surroundings quickly (1)
  - Plastic is an insulator, so loses heat more slowly (1)
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#### **Q25. Heating gases [5]**

(a)

- Higher temperature → particles gain kinetic energy (1)
  - Collide more often with container walls (1)
  - Collisions are harder, pressure increases (1)  
(b)
  - Particles move faster, spreading further apart (1)
  - Average spacing increases (1)
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#### **Q26. Density of irregular solids [4]**

- Measure mass using a balance (1)
- Place object in measuring cylinder of water (1)

- Record volume of displaced water (1)
  - Calculate density = mass  $\div$  volume (1)
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### Q27. Diffusion in liquids [4]

(a)

- Particles move randomly (1)
  - Spread from high concentration to low concentration (1)  
(b)
  - Higher temperature (1)
  - Lower density liquid / smaller particles (1)
- 

### Q28. Heating curve [5]

(a)

- Energy supplied used to break intermolecular forces (1)
  - Potential energy increases, not kinetic, so no temperature rise (1)
  - Explains flat section (1)  
(b)
  - Sketch: temperature vs time curve with 2 flat sections at 0 °C and 100 °C (1)
  - Correctly labelled melting and boiling points (1)
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### Q29. Evaporation [3]

(a)

- Highest energy particles escape from surface (1)

- Remaining particles have lower average energy, so liquid cools (1)  
(b) Example: sweating, puddles drying, washing drying (1)
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### Q30. Compressibility [4]

(a)

- Solids' particles are tightly packed (1)
  - No space to be compressed (1)  
(b)
  - Gas particles are far apart (1)
  - Can be pushed closer together when compressed (1)
- 

### Q31. Heating block [3]

Equation:  $E = mc\Delta\theta$

- Substitution:  $0.5 \times 900 \times 10$  (1)
  - = 4500 (1)
  - Final answer: 4500 J (1)
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### Q32. Liquids [3]

(a)

- Particles close together (1)
  - Move around randomly (1)  
(b) Can flow because particles can move past each other (1)
- 

### Q33. Gas pressure [4]

(a)

- Gas particles move randomly (1)
  - Collide with container walls (1)
  - Each collision exerts a force, creating pressure (1)  
(b) Factor: increase temperature / add more particles (1)
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### Q34. Cooling with lid [3]

- Lid reduces heat transfer by convection (1)
  - Traps warm air / reduces air circulation (1)
  - Slows overall cooling (1)
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### Q35. Gas law [3]

(a)

- Force = Pressure  $\times$  Area (1)
  - $1.0 \times 10^5 \times 0.01 = 1000 \text{ N}$  (1)  
(b) Pressure doubles if volume is halved (1)
- 

### Q36. Latent heat of fusion [5]

(a)

- Energy needed to change 1 kg solid to liquid (1)
- At constant temperature (1)  
(b)
- Energy supplied breaks bonds / forces between particles (1)
- Potential energy increases, not kinetic (1)

- So temperature stays the same (1)
- 

### Q37. Gas in syringe [4]

(a)

- Same number of particles in smaller space (1)
  - Collisions more frequent (1)
  - Greater force per unit area, so pressure rises (1)  
(b) More frequent collisions with walls (1)
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### Q38. Heating in metal container [3]

- Metal conducts heat better (1)
  - Transfers energy to liquid faster (1)
  - Plastic is an insulator, so slower heating (1)
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### Q39. Specific heat capacity [3]

(a)

- Substitution:  $c = 5000 \div (1.0 \times 20)$  (1)
  - Answer: 250 J/kg°C (1)  
(b) Larger block = more mass, requires more energy to raise temperature (1)
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### Q40. Flat section at boiling point [3]

- Energy supplied breaks intermolecular forces (1)
- Potential energy of particles increases (1)
- Temperature stays constant until change of state complete (1)

### Q41. Density of irregular solids [6]

- Apparatus: balance, measuring cylinder, water (1)
  - Measure mass using a balance (1)
  - Fill cylinder with water and record initial volume (1)
  - Place object in cylinder, record new volume (1)
  - Calculate displaced volume = final – initial (1)
  - Density = mass  $\div$  volume (1)  
(Precaution: read scale at eye level / avoid splashing  $\rightarrow$  credit as alternative mark)
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### Q42. Heating of a solid [5]

(a)

- Specific heat capacity = energy needed to raise temperature of 1 kg (1)
  - By 1 °C (or 1 K) (1)  
(b)
  - Energy increases kinetic energy of particles (1)
  - Particles vibrate faster (1)
  - Temperature rise = measure of average kinetic energy (1)
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### Q43. Pressure in gases [4]

(a)

- Heating increases kinetic energy of particles (1)
  - Collide more often with container walls (1)
  - Collisions are harder, exerting more force  $\rightarrow$  higher pressure (1)  
(b) Pressure  $\propto$  1  $\div$  Volume (at constant temperature) (1)
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#### Q44. Particle motion [6]

- (a) Solids: particles fixed in regular lattice (1), can only vibrate → fixed shape (1)  
(b) Liquids: particles close but not fixed (1), can slide past each other → can flow (1)  
(c) Gases: particles far apart (1), spaces allow them to be compressed (1)
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#### Q45. Latent heat [5]

- (a) Energy needed to change state of 1 kg liquid to gas (1)  
Without change in temperature (1)  
(b)
- Energy supplied breaks intermolecular forces (1)
  - Potential energy increases, not kinetic (1)
  - So temperature remains constant until all liquid turns to gas (1)
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#### Q46. Particle collisions and pressure [3]

- Gas particles move randomly and collide with walls (1)
  - Each collision exerts a force on wall (1)
  - Force over area = pressure (1)
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#### Q47. Diffusion [4]

- (a) Movement of particles from high to low concentration (1), due to random motion (1)  
(b) Higher temperature → particles gain more kinetic energy (1), move faster → diffuse quicker (1)
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#### Q48. Energy transfer in heating [3]

Equation:  $E = mc\Delta\theta$

- Substitution:  $1.2 \times 900 \times 15$  (1)

- = 16 200 J (1)
  - Final answer: 16.2 kJ or 16 200 J (1)
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#### **Q49. Cooling with a lid [3]**

- Lid reduces heat transfer by convection (1)
  - Traps warm air above liquid (1)
  - Reduces rate of energy loss to surroundings (1)
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#### **Q50. Gas force and pressure [3]**

(a) Force = Pressure  $\times$  Area

- Substitution:  $2 \times 10^5 \times 0.01 = 2000$  (1)
  - Final answer: 2000 N (1)
  - (b) Pressure doubles if volume halved (1)
- 

#### **Q51. Heating curve (melting/boiling) [3]**

- Energy supplied used to break intermolecular forces (1)
  - Increases potential energy, not kinetic (1)
  - So temperature remains constant (1)
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#### **Q52. Compressibility [3]**

- Solids: particles tightly packed, no space (1)
- Gases: particles far apart (1)
- Gas particles can be pushed closer together  $\rightarrow$  compressible (1)

**Q53. Thermal energy [3]**

(a)

- Metals have lower specific heat capacity (1)
  - So same energy input raises their temperature more (1)
  - (b) Water has high specific heat capacity (1)
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**Q54. Energy transfer [3]**

Equation:  $E = mc\Delta\theta$

- Substitution:  $0.8 \times 450 \times 60$  (1)
  - = 21 600 J (1)
  - Final answer: 21.6 kJ (1)
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**Q55. Diffusion in gases [3]**

- Higher temperature → particles gain kinetic energy (1)
- Move faster (1)
- Collide and spread out quicker (1)