Mark scheme 5054/2 – Theory November 2001

1(a)	acceleration and velocity	1
(b)(i)	forces in opposite directions	1
(ii)	forces in the same direction	1
(iii)	closed triangle or diagonal and sides of parallelogram drawn	
	equilateral triangle with resultant clear and correct direction on 3 vectors	2
2(a)	0ºC or 273K	1
(b)	use of proportionality clear in calculation e.g. 18/24x100 or 91.7 or 78.6	
	75(ºC)	2
(c)	2.4 x 100 = 240 (J)	1
(d)	resistance / (thermocouple) e.m.f. or voltage/ pressure of gas /colour etc	1
3(a)(i)	correct indication of compression at point where coils are closest	
(ii)	springs/coils/atoms/molecules closer (than usual) or compressed or pressure is higher	
(iii)	springs/atoms/molecules vibrate or oscillate about a mean position	
	or oscillate back and forth or parallel to wave	
	or waves longitudinal **or** no overall movement of molecules	3
(b)(i)	2.6-3.0 cm	1
(ii)	v =f λ	
	75 / b(i)	
	25-29 Hz 2 or 3 significant figures only	3
4(a)	2.4-2.9 mm **or** cm **or** dm	1
(b)	light refracts or bends towards normal	
	slows down / wavelength is less / frequency constant	2
(c)	(i) correct refraction with rays **not** meeting before or on the bottom of the disc	1
	(ii) 0.5-1.2 mm (ie penalty for scale error)	1
(d)	move lens up (accept away, backwards)	1
5(a)	I=P/V	
	2500/240 = 10.4(A)	2
(b)(i)	1.25 (mm)	1
(ii)	larger resistance or heating related to resistance in any way	
	wire overheats /melts /burns / melts insulation	2
(c)	wires short circuit or touch / L touches N or E / damage to insulation / water	
	inside insulation	1
6(a)	at least 3 lines approximately parallel in centre and perpendicular to ground	

	direction on at least 1 line from positive to negative charge	2

(b)(i) electrons or negative charge on drop1 move to drop 2
or charges neutralise/cancel each other on the two drops (not just + attracts -)   1

(ii) **1** positive or + **and 2** negative or –   1

(c) work done or energy/charge or definition of volt as J/C   1

7(a)(i) magnetic field lines of magnet or magnetic lines of force or magnetic flux
cut coil or flux through coil changes or current/emf is induced   2

(ii) N (pole)   1

(b)(i) (brief**)** current/ammeter reading in opposite direction or backwards
or S pole at left of coil   1

(ii) no current or ammeter reading or nothing happens   1

8(a) Any two from:
nucleus is unstable/emits/decays/changes/disintegrates/becomes stable,
(the change occurs) at random/spontaneously,
emitting alpha or beta or gamma particles   2

(b) gamma-rays are penetrating /only stopped by thick material or lead / ionising
kill cells or bacteria/viruses/germs or have high energy   2

(c) Any two from:
rays are dangerous /harmful/cause death/illness or cancer / kill cells/ cause mutations,
rays spread out / more rays miss the body / minimises absorption by body,
air absorbs some radiation / α or β-particles short distance in air   2

9(a)(i) molecules/particles/atoms vibrate or hit each other
pass on energy/vibration from one to the next   2

(ii) K.E. decreases or stays constant on average
P.E. increases or K.E. goes to P.E.   2

(iii) molecules move around molecules hit **walls**   2

(b)(i) F=PA
$3.0 \times 10^5 \times 2.0 \times 10^{-4}$ [$(3.0 \times 10^5 + AP) \times 2.0 \times 10^{-4}$ allowed]
60 N   3

(ii) attempt at moment calculation, using mass or weight
$60 \times 5 = M \times 15$ or $6 \times 5 = M \times 15$
conversion of (i) to mass or **result** of moment calculation to mass
2 kg or (i)/30   4

(iii) decrease mass **M** / decrease distance **M** to pivot / increase distance valve to pivot
/ increase area valve   2

10(a)(i) current **in coil/solenoid** in either figure
iron core (inside coil) magnetised
pivoted soft iron magnetised or attracted
contacts close or circuit completed   4

(ii)   flexible or fixed soft-iron magnetised (by current in coil)

two pieces of soft iron **attract** or opposite poles **attract**   2

(iii)   Any two of:

moving parts smaller or less massive in reed relay

contacts are closer

relay takes time to pull spring across

    2

(b)(i)   thermistor resistance decreases

current in relay coil **increases (**not starts to flow)   2

(ii)   **1**   R=V/I

        2/0.1

        20 Ω

      2   10V   1

      3   100Ωor2/0.1   2

11(a)(i)   s = distance x time = 15 x 20

300m   2

(ii)   Force x distance = 1200 x (i)

360000 J   2

(iii)   P = W(or E)/t = 360000/20

18000 W   2

(b)(i)   K.E. = ½ mv^2

        = ½ 800. 15^2

        = 90000 J   3

(ii)   **1**   (to work/provide force against) air resistance / friction

      2   heat (internal/thermal energy) in air/road/tyres/wheels/surroundings

         or air turbulence/ K.E. of air   2

(c)(i)   a =(v-u)/t = 15/4

a = 3.7(5) m/s^2 2

(ii)   3000N   (or (c)(i) x 800)   1

(iii)   car or wheel or drum moves faster /turns faster or

use of power = force x velocity clear   1