Willpower

A Although willpower does not shape our decisions, it determines whether and how long we can follow through on them. It almost single-handedly determines life outcomes. Interestingly, research suggests the general population is indeed aware of how essential willpower is to their wellbeing; survey participants routinely identify a 'lack of willpower' as the major impediment to making beneficial life changes. There are, however, misunderstandings surrounding the nature of willpower and how we can acquire more of it. There is a widespread misperception, for example, that increased leisure time would lead to subsequent increases in willpower.

B Although the concept of willpower is often explained through single-word terms, such as 'resolve' or 'drive', it refers in fact to a variety of behaviours and situations. There is a common perception that willpower entails resisting some kind of a 'treat', such as a sugary drink or a lazy morning in bed, in favour of decisions that we know are better for us, such as drinking water or going to the gym. Of course this is a familiar phenomenon for all. Yet willpower also involves elements such as overriding negative thought processes, biting your tongue in social situations, or persevering through a difficult activity. At the heart of any exercise of willpower, however, is the notion of 'delayed gratification', which involves resisting immediate satisfaction for a course that will yield greater or more permanent satisfaction in the long run.

C Scientists are making general investigations into why some individuals are better able than others to delay gratification and thus employ their willpower, but the genetic or environmental origins of this ability remain a mystery for now. Some groups who are particularly vulnerable to reduced willpower capacity, such as those with addictive personalities, may claim a biological origin for their problems. What is clear is that levels of willpower typically remain consistent over time (studies tracking individuals from early childhood to their adult years demonstrate a remarkable consistency in willpower abilities). In the short term, however, our ability to draw on willpower can fluctuate dramatically due to factors such as fatigue, diet and stress. Indeed, research by Matthew Gailliot suggests that willpower, even in the absence of physical activity, both requires

and drains blood glucose levels, suggesting that willpower operates more or less like a 'muscle', and, like a muscle, requires fuel for optimum functioning.

D These observations lead to an important question: if the strength of our willpower at the age of thirty-five is somehow pegged to our ability at the age of four, are all efforts to improve our willpower certain to prove futile? According to newer research, this is not necessarily the case. Gregory M. Walton, for example, found that a single verbal cue – telling research participants how strenuous mental tasks could 'energise' them for further challenging activities – made a profound difference in terms of how much willpower participants could draw upon to complete the activity. Just as our willpower is easily drained by negative influences, it appears that willpower can also be boosted by other prompts, such as encouragement or optimistic self-talk.

E Strengthening willpower thus relies on a two-pronged approach: reducing negative influences and improving positive ones. One of the most popular and effective methods simply involves avoiding willpower depletion triggers, and is based on the old adage, 'out of sight, out of mind'. In one study, workers who kept a bowl of enticing candy on their desks were far more likely to indulge than those who placed it in a desk drawer. It also appears that finding sources of motivation from within us may be important. In another study, Mark Muraven found that those who felt compelled by an external authority to exert self-control experienced far greater rates of willpower depletion than those who identified their own reasons for taking a particular course of action. This idea that our mental convictions can influence willpower was borne out by Veronika Job. Her research indicates that those who think that willpower is a finite resource exhaust their supplies of this commodity long before those who do not hold this opinion.

F Willpower is clearly fundamental to our ability to follow through on our decisions but, as psychologist Roy Baumeister has discovered, a lack of willpower may not be the sole impediment every time our good intentions fail to manifest themselves. A critical precursor, he suggests, is motivation – if we are only mildly invested in the change we are trying to make, our efforts are bound to fall short. This may be why so many of us abandon our New Year's Resolutions – if these were actions we really wanted to take, rather than things we felt we ought to be doing, we would probably be doing them already. In

addition, Muraven emphasises the value of monitoring progress towards a desired result, such as by using a fitness journal, or keeping a record of savings toward a new purchase. The importance of motivation and monitoring cannot be overstated. Indeed, it appears that, even when our willpower reserves are entirely depleted, motivation alone may be sufficient to keep us on the course we originally chose.

Questions 1-7

Do the following statements agree with the information given in Reading Passage?

*In boxes **1-7** on your answer sheet, write*

TRUE if the statement agrees with the information

FALSE if the statement contradicts the information

NOT GIVEN if there is no information on this

1 Willpower is the most significant factor in determining success in life.

2 People with more free time typically have better willpower.

3 Willpower mostly applies to matters of diet and exercise.

4 The strongest indicator of willpower is the ability to choose long-term rather than short-term rewards.

5 Researchers have studied the genetic basis of willpower.

6 Levels of willpower usually stay the same throughout our lives.

7 Regular physical exercise improves our willpower ability.

Questions 8-13

Look at the following statements (Questions 8-13) and the list of researchers below.

Match each statement with the correct person, **A–D**.

*Write the correct letter, **A–D**, in boxes **8-13** on your answer sheet.*

NB *You may use some letters more than once.*

8 ____ identified a key factor that is necessary for willpower to function.

9 ____ suggested that willpower is affected by our beliefs.

10 ____ examined how our body responds to the use of willpower.

11 ____ discovered how important it is to make and track goals.

12 ____ found that taking actions to please others decreases our willpower.

13 ____ found that willpower can increase through simple positive thoughts.

List of People

A Matthew Gailliot

B Gregory M. Walton

C Mark Muraven

D Veronika Job

E Roy Baumeister

Question 14

Which of the following is **NOT** mentioned as a factor in willpower?

Willpower is affected by:

A ○ physical factors such as tiredness

B ○ our fundamental ability to delay pleasure

C ○ the levels of certain chemicals in our brains

D ○ environmental cues such as the availability of a trigger

Sunny Days For Silicon

A The old saw that "the devil is in the details" characterizes the kind of needling obstacles that prevent an innovative concept from becoming a working technology. It also often describes the type of problems that must be overcome to shave cost from the resulting product so that people will buy it. Emanuel Sachs of the Massachusetts Institute of Technology has struggled with many such little devils in his career-tong endeavor to develop low-cost, high-efficiency solar cells. In his latest effort, Sachs has found incremental ways to boost the amount of electricity that common photovoltaics (PVs) generate from sunlight without increasing the costs. Specifically, he has raised the conversion efficiency of test cells made from multi-crystalline silicon from the typical 15.5 percent to nearly 20 percent—on par with pricier single-crystal silicon cells. Such improvements could bring the cost of PV power down from the current $1.90 to $2.10 per watt to $1.65 per watt. With additional tweaks, Sachs anticipates creating within Four years solar cells that can produce juice at a dollar per watt, a feat that would make electricity (rum the sun competitive with that from coal-burning power plants.

B Most PV cells, such as those on home rooftops, rely on silicon to convert sunlight into electric current. Metal interconnects then funnel the electricity out from the silicon to power devices or to feed an electrical grid. Since solar cells became practical and affordable three decades ago, engineers have mostly favored using single-crystal silicon as the active material, says Michael Rogol, managing director of Germany- based Photon Consulting. Wafers of the substance are typically sawed from an ingot consisting of one large crystal that has been pulled like taffy out of a vat of molten silicon. Especially at first, the high-purity ingots were left over from integrated-circuit manufacture, but later the process was used to make PV cells themselves, Rogol recounts. Although single-crystal cells offer high conversion efficiencies, they are expensive to make.

The alternatives- multi-crystalline silicon cells, which factories fabricate from lower-purity, cast ingots composed of many smaller crystals—are cheaper to make, but unfortunately they are less efficient than single-crystal cells.

C Sachs, who has pioneered several novel ways to make silicon solar cells less costly and more effective, recently turned his focus to the details of multi-crystalline silicon cell manufacture. The first small improvement concerns the little silver fingers that gather electric current from the surface of the bulk silicon," he explains. In conventional fabrication processes, cell manufacturers use screen-printing techniques ("like high-accuracy silk-screening of T-shirts," Sachs notes) and inks containing, silver particles to create these bus wires. The trouble is that standard silver wires come out wide and short, about 120 by 10 microns, and include many nonconductive voids. As a result, they block considerable sunlight and do not carry as much current as they should.

D At his start-up company—Lexington, Mass- based 1366 Technologies (the number refers to the flux of sunlight that strikes the earth's outer atmosphere: 1.366 watts per square meter)—Sachs is employing "a proprietary wet process that can produce thinner and taller" wires that are 20 by 20 microns. The slimmer bus wires use less costly silver and can be placed closer together so they can draw more current from the neighboring active material, through which free electrons can travel only so far. At the same time, the wires block less incoming light than their standard counterparts.

E The second innovation alters the wide, flat interconnect wires that collect current from the silver bus wires and electrically link adjacent cells. Interconnect wires at the top can shade as much as 5 percent of the area of a cell. "We place textured mirror surfaces on the faces of these rolled wires. These little mirrors reflect incoming light at a lower angle--around 30 degrees-—so that when the reflected rays hit the glass layer at Lire top, they stay within the silicon wafer by way of total internal reflection," Sachs explains. (Divers and snorkelers commonly see this optical effect when they view water surfaces from below.) The longer that light remains inside, the more chance it has to be absorbed and transformed into electricity.

F Sachs expects that new antireflection coatings will further raise multi-crystal line cell efficiencies. One of his firm's future goals will be a switch from

expensive silver bus wires to cheaper copper ones. And he has a few ideas regarding how to successfully make the substitution. "Unlike silver, copper poisons the performance of silicon PVs," Sachs says, "so it will be crucial to include a low-cost diffusion barrier that stops direct contact between copper and the silicon." In this business, it's always the little devilish details that count.

G The cost of silicon solar cells is likely to fall as bulk silicon prices drop, according to the U.S. Energy information Administration and the industry tracking firm Solarbuzz. A steep rise in solar panel sales in recent years had led to a global shortage of silicon because production capacity for the active material lagged behind, but now new silicon manufacturing plants are coming online. The reduced materials costs and resulting lower system prices will greatly boost demand for solar-electric technology, according to market watcher Michael Rogol of Photon Consulting.

Questions 1-5

Use the information in the passage to match the people or companies (listed A-C) with opinions or deeds below. Write the appropriate letters A-C in boxes 1-5 on your answer sheet.

NB you may use any letter **more than once**

A. Emanuel Sach

B. Michael Rogol

C. Solarbuzz

1 [ ] Gives a brief account of the history of the common practice to manufacture silicon batteries for a long time.

2 [ ] Made a joint prediction with another national agency.

3 [ ] Established an enterprise with a meaningful name.

4 [ ] Led forward in the solar-electric field by reducing the cost while raising the efficiency.

5 [ ] Expects to lower the cost of solar cells to a level that they could contend with the traditional way to generate electricity.

Questions 6-9

Do the following statements agree with the information given in Reading Passage?

In boxes 6-9 on your answer sheet, write

TRUE *if the statement is true*

FALSE *if the statement is false*

NOT GIVEN *if the information is not given in the passage*

6 [ ] The Achille's heel of single-crystal cells is the high cost.

7 [ ] The multi-crystalline silicon cells are ideal substitutions for single-crystal cells.

8 [ ] Emanuel Sachs has some determining dues about the way to block the immediate contact between an alternative metal for silver and the silicon.

9 [ ] In the last few years, there is a sharp increase in the demand for solar panels.

Questions 10-14

Complete the following summary of the paragraphs of Reading Passage, using No More than Three words from the Reading Passage for each answer. Write your answers in boxes 10-14 on your answer sheet.

Emanuel Sachs made two major changes to the particulars of the manufacture **10** [ ]. One is to take a **11** [ ] in the production of finer wires which means more current could be attracted from the **12** [ ]. The other one is to set **13** [ ] above the interconnect silver bus wires to keep the incoming sunlight by **14** [ ].